AVIATION WEEK

JAN. 17, 1955

50 CENTS

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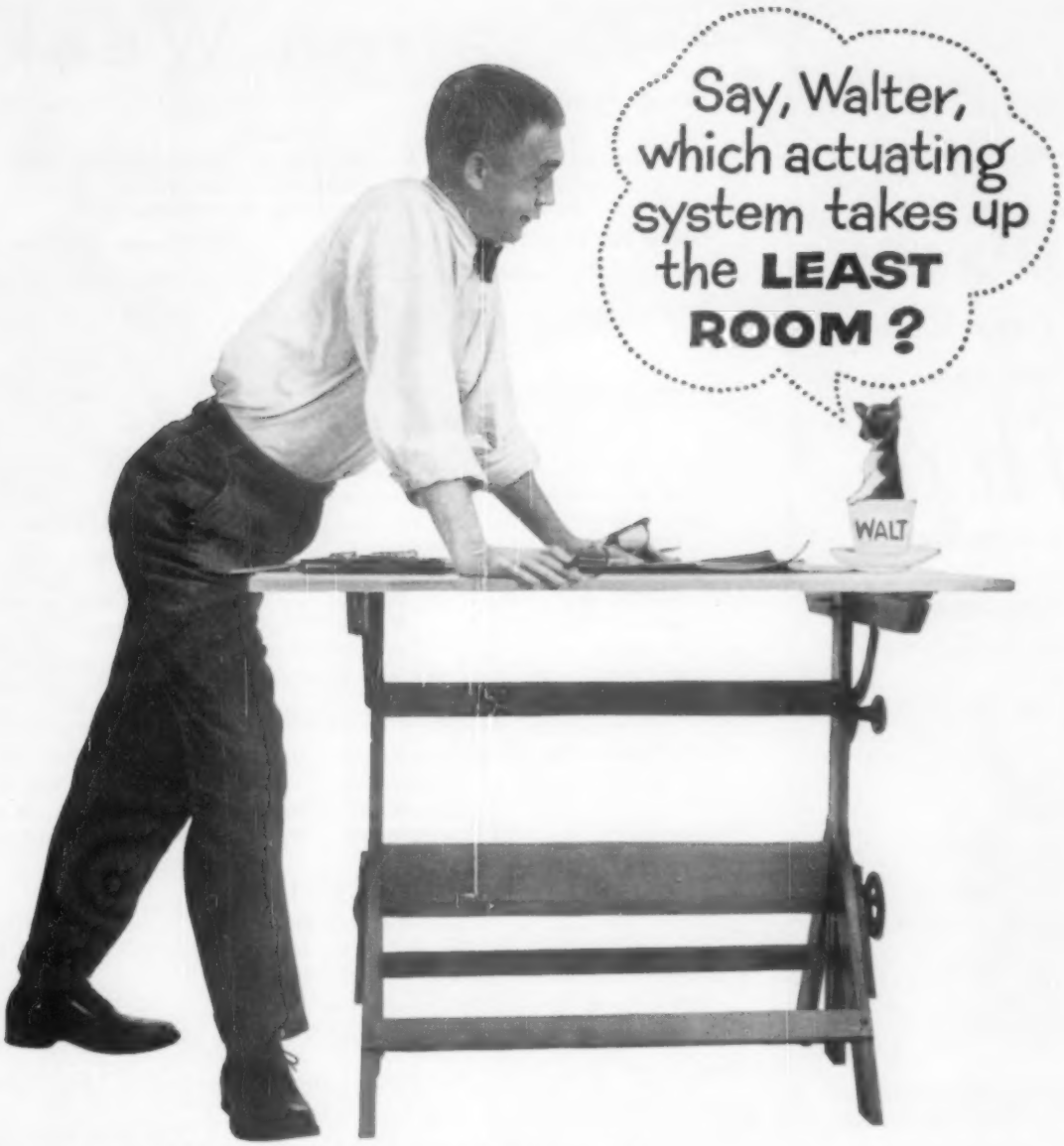
A—18



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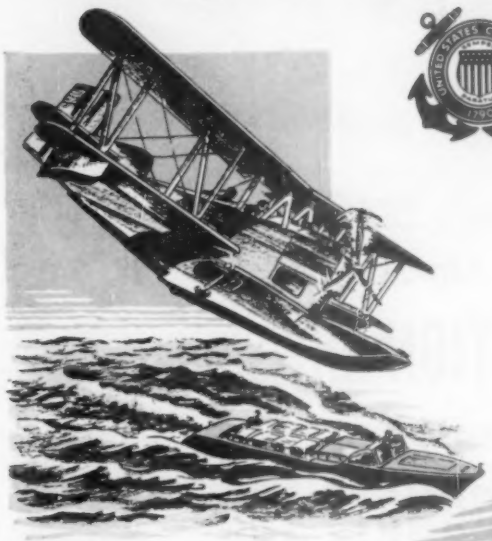
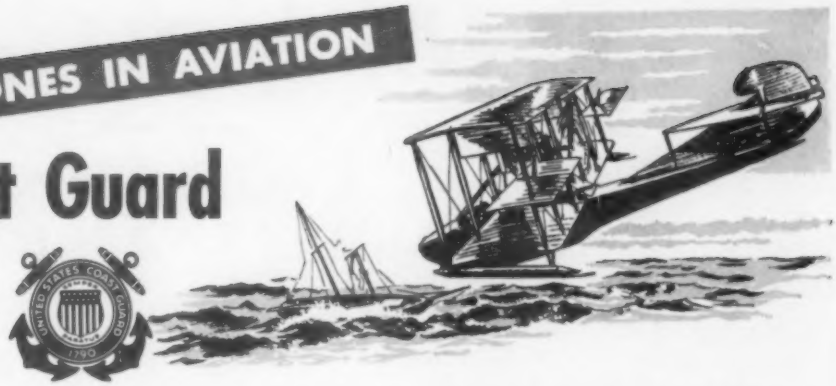
Phillips 66
PRESENTS

MILESTONES IN AVIATION

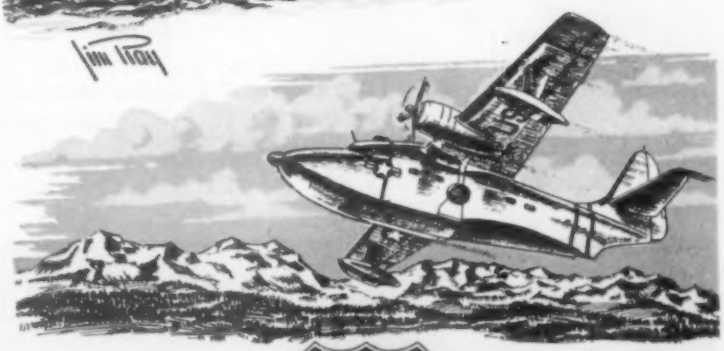
Flying Coast Guard





In 1915 three officers of the U. S. Coast Guard, using an airplane borrowed from the Navy, proved the value of aviation in searching for lost and disabled vessels along the Atlantic Coast. In 1916 Congress authorized the Treasury Department to establish ten Coast Guard Air Stations along our coasts, but it was many years before such authorization was carried out. Meanwhile, however, the idea was kept alive by the efforts of a few air-minded Coast Guardsmen using obsolete planes borrowed from the Navy.

In the late Twenties, the bold activities of smugglers and rum runners brought a sizable appropriation for planes and Coast Guard Air Stations. Since that time, U. S. Coast Guard Aviation has proved of invaluable service in war and peace from the Tropics to the Arctic.



For more than 30 years, the research and development activities of Phillips Petroleum Company have been actively concerned with aviation fuels and lubricants. Today, the Phillips research staff is constantly working on problems related to aviation.

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NEWS DIGEST

Domestic

Trans World Airlines 2-0-2 and an executive DC-3 collided last week in a mid-air crash southwest of the Greater Cincinnati Airport, killing 13 persons on the TWA transport and two on the business plane.

National Airlines' Lodestar crashed on takeoff from St. Petersburg, Fla., but the 10 passengers and three crewmen escaped from the burning transport without injury. Witnesses said the Lodestar's power apparently failed as it became airborne.

Super Constellation rollouts at Lockheed Aircraft Corp.'s Burbank plant last year broke all company records for civil transport production, increasing to 41 airliners with a combined value of more than $70 million. Backlog Dec. 31: 68 Super Connies.

Low flying suit to impose additional curbs on aircraft traffic at Newark (N. J.) Airport was dismissed last week by Federal Judge William F. Smith after an assistant U. S. attorney challenged the court's jurisdiction over the federal government and Civil Aeronautics Administration. A second section of the suit, brought against the Port of New York Authority and seven airlines by New Jersey municipal groups, still is awaiting trial.

New multi-code radar transponder beacon, developed by Melpar, will get its first industry showing Jan. 25 at a closed Air Transport Assn. meeting in Indianapolis. Six of the new 27-lb. beacons were installed recently on Lake Central Airlines' fleet of DC-3s as part of Air Navigation Development Board's evaluation program (AVIATION WEEK Nov. 8, p. 11). The beacons are expected to increase the effectiveness of ground radar traffic control.

Lockheed Aircraft Corp. broke ground last week at Van Nuys, Calif., for a new $4-million guided missiles research laboratory, the first of four similar structures to be built for the company's Missile Systems Division under a $10-million master development program.

Kaman Aircraft Corp. has formed a new wholly owned subsidiary, Kaman Aircraft of Canada at St. Catharines, Ont.

Bendix Aviation Corp. has set up an Aircraft Products Division of its wholly owned subsidiary, Bendix-Eclipse of Canada, Ltd. The new division now is in temporary offices at Toronto.

Navy Copter Gets Big Power Boost

Wright R1300-3 engine of 700 hp. is fitted in this modification of the Piasecki HUP-2 helicopter, normally powered by a 475-hp. Continental R975-46. HUP-4 is the designation of the new Piasecki. The program covers two phases: (1.) installation of the R1300-3 for flight tests and (2.) incorporation of new dynamic components capable of fully utilizing the increased power. The Piasecki HUP-2, HUP-3 and H-25A all can be retrofitted to have the improved performance of the HUP-4.

New $20-million buildup will begin next May at McClellan Air Force Base near Sacramento, Calif., will include hangars, supply and operational buildings for the Air Defense Command's 8th Air Division early warning picket unit plus expansion of warehouse facilities.

Air Force plans to take over facilities of Army's Marietta, Pa., transportation depot, due to critical USAF need for storage space in the area. By consolidating the storage activities of the Marietta depot with the New Cumberland, Pa., depot, Defense Department estimates $1.5-million annual decrease in operating costs.

Financial

De Havilland Aircraft of Canada, Ltd., Toronto, reports a net profit of $121,934 for the fiscal year ended Sept. 30, dropping from $177,168 for the previous 12-month period. The company says its lower profits reflect the cost of moving into its new 600,000-sq. ft. plant (AVIATION WEEK Aug. 23, p. 34).

Fleet Manufacturing Co., Ft. Erie, Ont., Canadian manufacturer for Doman Helicopters and Helio Aircraft Corp., had a net profit of $436,451 for 1954, compared with $401,264 in 1953.

International

Production stretchout of twin-jet CF-100s will begin late this month at A. V. Roe Canada's Toronto plant, extending work on the all-weather fighter until the new delta-wing CF-105 is ready for assembly lines in 1958. The slowdown, ordered by the Canadian government, will force Avro to lay off about 1,000 employees and cut production 20%.

Saskatchewan Government Airways' twin-engine transport crashed 85 mi. from Prince Albert, Sask., Jan. 6, killing seven persons, according to press reports from Canada. The reports did not identify the transport, but the nonscheduled airline's twin-engine equipment includes only three Ansons and one DC-3.

Pakistan International Airlines, new government-owned carrier formed through nationalization of the country's Orient Airways and National Air Co., is scheduled to begin Karachi-London service Jan. 19, according to press reports. Capitalization of the new airline: more than $14,560,000.

Alfred Colsman, 81, co-worker of the late Count Von Zeppelin and founder of one of the world's first dirigible airlines, the German Airship Travel Co., died Jan. 9 at Dortmund, Germany.

Fifty Avro Canada CF-100s will be converted to dual-control trainers by Canada's MacDonald Brothers Aircraft, Ltd., Winnipeg, under a new contract from the Royal Canadian Air Force. Total contract: $3 million.

Finland is negotiating with Russia for MiG-15 jet fighters, according to local press reports in Helsingfors.

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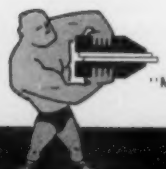

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The Aviation Week

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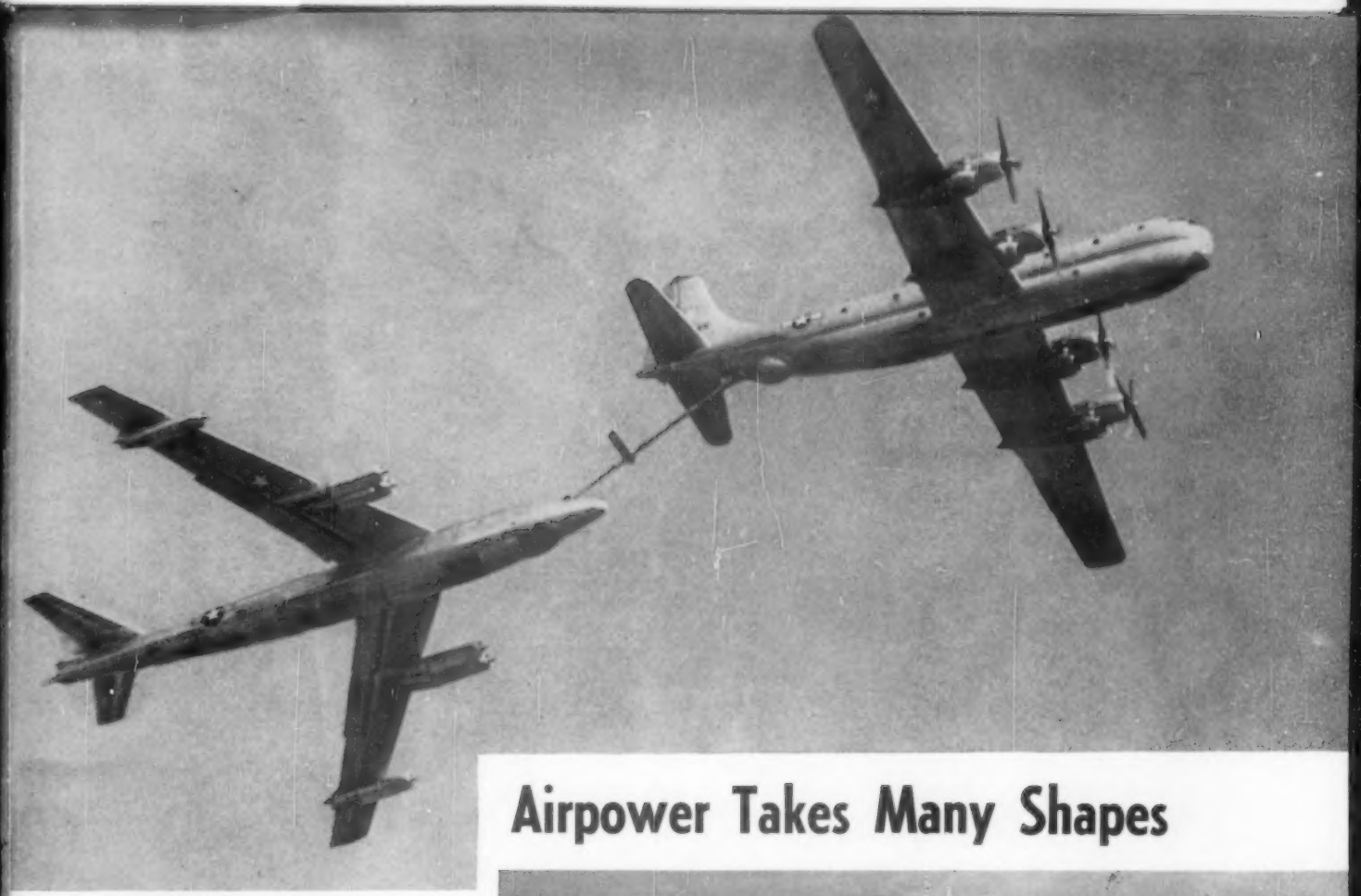
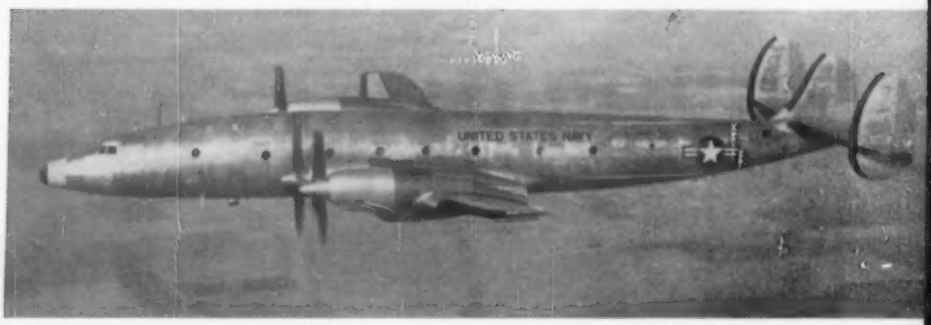
Airpower Takes Many Shapes

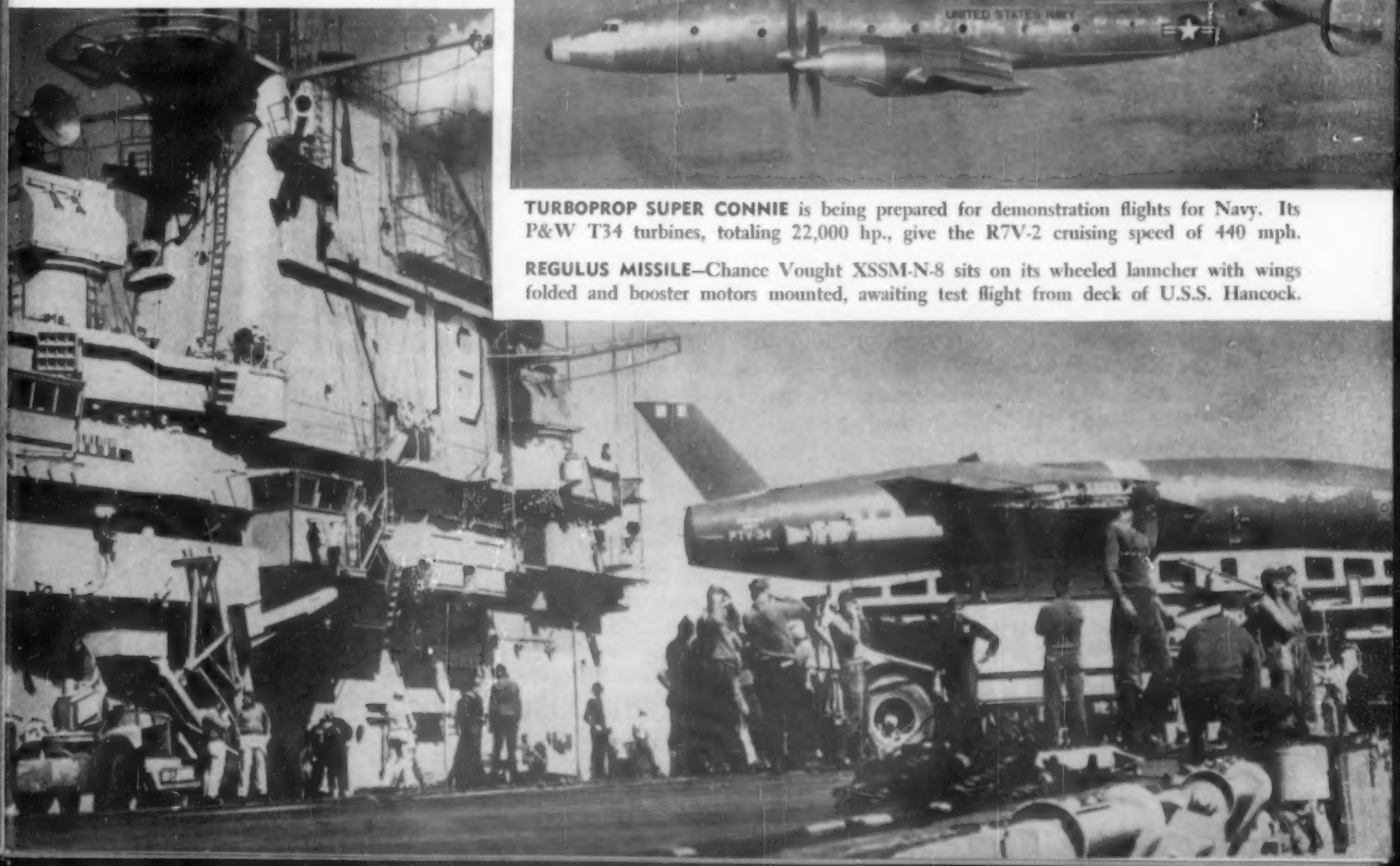


MIDAIR REFUELING of Boeing RB-47E by Boeing KC-97F tanker illustrates technique that gives jets almost unlimited range.



TURBOPROP SUPER CONNIE is being prepared for demonstration flights for Navy. Its P&W T34 turbines, totaling 22,000 hp., give the R7V-2 cruising speed of 440 mph.

REGULUS MISSILE—Chance Vought XSSM-N-8 sits on its wheeled launcher with wings folded and booster motors mounted, awaiting test flight from deck of U.S.S. Hancock.



TITANIUM helps the Voodoo work its magic...

McDonnell's new F-101 Voodoo, a supersonic long-range strategic fighter capable of delivering atomic weapons, depends upon REM-CRU titanium for vital parts . . . just as do most other advanced-type aircraft.

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WHO'S WHERE

In the Front Office

Corwin D. Denney has resigned as general manager of American Helicopter Division of Fairchild Engine & Airplane Co., to devote his full time to being president of Mid-Continent Manufacturing, Inc., Manhattan Beach, Calif., aircraft subcontractor.

John A. Thompson, assistant counsel for Republic Aviation Corp., has taken on additional duties as secretary of the Farmingdale, N. Y., company. **Thomas Davis**, longtime secretary-treasury, now will give full time to his position as treasurer.

Changes

John G. Lee is new director of research for United Aircraft Corp., succeeding **Frank W. Caldwell**, who retired after serving 25 yr. with UAC and its Hamilton Standard Division.

R. James Pfeiffer has been appointed commercial sales director for Fairchild Engine & Airplane Corp., Hagerstown, Md.

A. C. Omberg has been promoted to assistant general manager of Bendix Aviation Corp.'s guided missile section, Mishawaka, Ind. **W. P. Bollinger** is new assistant director-engineering of the section.

Bruce F. Grimm has become chief engineer of Electrocircuits, Inc., Pasadena, Calif., and has taken over the firm's new Potentiometer Division.

Ansel E. Talbert has been appointed military and aviation editor of the New York Herald Tribune.

Honors and Elections

Robert E. Gross, president and board chairman of Lockheed Aircraft Corp., has been elected president of the Institute of the Aeronautical Sciences for 1955, succeeding **J. L. Atwood**, president of North American Aviation, Inc. New IAS vice presidents for 1955: **Roger Wolfe Kahn**, test pilot-service manager, Grumman Aircraft & Engineering Corp.; **Dr. Edward R. Sharp**, director of Lewis Flight Propulsion Laboratory of the National Advisory Committee for Aeronautics; **Edward C. Wells**, vice president-engineering, Boeing Airplane Co.; **T. Claude Ryan**, president of Ryan Aeronautical Co. New treasurer: **Charles H. Colvin.**

F. E. Carroll, Jr., chief engineer of United Aircraft Products, Inc., was installed last week as vice president-aircraft powerplant activity of the Society of Automotive Engineers at its golden anniversary annual meeting in Detroit.

Walter Tydon, chief engineer of Fairchild Engine & Airplane Corp., Hagerstown, Md., has been re-elected chairman of the 1955 Air Cargo Advisory Committee, National Security Industrial Assn. **George W. Westphal**, preliminary design engineer for Fairchild, and **Robert W. Johnson**, customer relations representative, will serve as members of the committee. **L. R. Hackney**, Fairchild administrative assistant, is new chairman of the airframe task committee

INDUSTRY OBSERVER

► Piasecki Helicopter Corp. will put its military H-21 Work Horse helicopter through CAA certification this year and estimates it will be ready for delivery to commercial operators in early 1956. Civilian Work Horse will be the PH-42, modification of the USAF and Army H-21B and C, grossing 13,300 lb. with 1½ to 2 tons payload. Price: $250,000 to $275,000, depending on equipment and furnishings. Interior configuration will be to customer's order. Powerplant being used is Wright 1820-103 engine, which provides 1,425 hp. at takeoff.

► First production plastic drop tank to go into production in this country will be built by Chicago Molded Products Corp., a division of Admiral Distributors Corp., under a contract for 10,000 of the fibrous glass-reinforced 225-gal. units. Company got green light to go ahead, even though tank has not passed its final flight tests. Tank is a Type IV, limited service unit, completely assembled at the factory (Aviation Week Jan. 3, p. 34).

► Chance Vought's Regulus surface-to-surface missile, fitted with cast magnesium outer wing panels, is scheduled to make its first flight this month. The new panels—forming the section outboard of the wing fold—weigh 162 lb., compared with 229 lb. for sheet-metal construction, and are expected to cut costs and speed production. Regulus magnesium panel is made by R. H. Osbrink Mfg. Co., Los Angeles. Chance Vought also is investigating the possibility of casting Regulus ailavators from magnesium to replace present assemblies.

► Lockheed Aircraft Corp. has opened a service school at its Marietta, Ga., plant to train company and Air Force personnel in maintenance and use of the new C-130 Hercules turboprop transport. Georgia plant is sole source for the C-130. Its first Hercules is expected to fly this spring.

► First Italian-built North American F-86K Sabre jet is expected to come off the Fiat assembly line at Turin in April. Fifty Sabres are being built by Fiat for NATO under a $22.5-million offshore procurement program (Aviation Week Aug. 2, 1954, p. 56).

► Australian mission now in the U.S. looking for replacement aircraft for the Royal Australian Air Force probably will select the British Avro Vulcan as their bomber, London sources report. Total purchase of 30 Vulcans is expected. Some will be produced in Britain, others in Australia. Present 85-plane production run of F-86 Sabres in Australia may be extended by 15 planes to keep lines working during toolup for a new fighter.

► Name of Hughes Aircraft Co. may be changed. Armament, aircraft and subassembly activities would be placed under an aeronautical division of Hughes Tool Co.; fire control and other avionics work would be carried on by a Hughes Electronic Development Co. This would confirm an arrangement which has been in existence since Howard Hughes gave the avionics section of the company to Howard Hughes Medical Institute a year ago (Aviation Week Jan. 18, 1954, p. 14).

► USAF continues to wrestle with problem of two grounded fighter planes. Republic F-84F cannot be flown if it is powered by the Wright J65-B-3, J65-W-3 or YJ65 and has less than 25 hours on the engine. North American F-100 Super Sabre will stay grounded while evaluation is made of changes aimed at overcoming highspeed yaw condition. Only test aircraft are flying at the present time.

► Hughes Aircraft Co. has been flying a Convair F-102 from its Culver City Airport for evaluation of the Hughes-built fire control systems.

► Army is preparing to order a substantial number of de Havilland Otters, designed in Canada. Otter is capable of carrying 14 equipped soldiers and extra ammunition. Empty weight of the aircraft is just below the 5,000-lb. limitation specified for Army fixed-wing aircraft in an agreement with the United States Air Force.

AVIATION WEEK VOL. 62, NO. 3

Washington Roundup

Procurement Investigation

Defense Secretary Charles E. Wilson's insistence that he did not reverse his procurement policy last month when he ordered the armed forces to spread their contracts among more producers is one of the topics most certainly headed for congressional investigation.

In addition to the Pentagon press corps and a lot of contractors, there are at least two men on Capitol Hill who remain skeptical. They are Senators Estes Kefauver (D., Tenn.) and Henry M. Jackson (D., Wash.)—the same men who hailed the new Wilson directive as a sign that big corporations would be forced to share the gravy. Wilson let them down hard by announcing: (a) that he had not changed policy, and (b) that he didn't have time to tell the senators about his directive anyhow (AVIATION WEEK Jan. 3, p. 12).

Now Kefauver says he personally will look into the question. And Jackson will have defense procurement reviewed by the Armed Services Committee.

Meanwhile, Wilson's denial of a shift in policy has gained no substance from the Office of Defense Mobilization, where they have set a goal of dispersing up to 40% of military production away from 70 target areas. ODM feels that the Wilson directive is a good change, allowing premium prices to be paid when necessary to dispersed, high-cost producers.

Service to India

The bilateral agreement with India has expired without a new one being signed, although talks have been going on for several months. Big stumbling block is India's insistence on limiting U. S. carrier traffic. State Department insists that no restriction should be put on traffic until damage to a local carrier is established, while India wants to write limitations into the agreement, apparently in the interest of giving Air-India a boost.

While talks continue, Pan American World Airways and Trans World Airlines will be allowed to operate two roundtrips weekly instead of three as in the past.

In a separate hassle with the State Department, Air-India International got an export license for the first of three Super Constellations scheduled for delivery early this year. State Department has control over all licenses for munitions, which includes airplanes, and India ran into some trouble before the license was issued.

Apparently the holdup was caused by speculation that India might use the airplane to inaugurate service to communist China; the State Department said it had nothing to do with the bilateral agreement. The license was issued with the usual restrictions against resale without U. S. clearance.

Missile Test Expansion

Department of Commerce procurement synopsis has let a new cat out of the Air Force bag: Eglin Air Force Base, Air Proving Ground Command, is launching an expansion program to facilitate its testing of airborne missiles. Recent synopsis reveals Falcon air-to-air and Rascal air-to-ground projects will get new homes there. Falcon building will be for storage and assembly, Rascal building for assembly and testing.

In addition, there will be new storage facilities for nitric acid and hydrazine, a blast revetment and acid disposal system. Supporting these will be an elaborate facility with rail lines, water supply, roads, drainage, toilet and shower facilities.

USAF grudgingly admitted that the new plant is designed to fit into future missile-testing programs, but refused further information.

Feeder Certification?

Look for Civil Aeronautics Board to do some soul searching and shift ground on local service certification. Chances are good that the Board will move toward permanent certification, or at least a liberal extension of the term, of one or more local service airlines. Reason is that the Board will try to head off congressional action which would certificate all feeder lines permanently, which the CAB opposes.

Mohawk Airlines, riding the crest of a favorable finding in the CAB local service report to the Senate Interstate Commerce Committee and an improved financial situation, is probably the likeliest candidate for Board action (see page 99).

On-Again, Off-Again

The White House persisted in its vacillation on Civil Aeronautics Board vacancy when it retreated from the nomination of Harold A. Jones, U. S. representative to the International Civil Aviation Organization, which was considered all but an accomplished fact.

Observers figure the local service airlines had a veto power on the appointment and turned thumbs down on Jones, feeling that his appointment wouldn't be in their interest. Jones was in Washington for several days, then left for Montreal and his current post with ICAO. Deal was that Jones would be appointed to the CAB and Oswald Ryan, outgoing CAB member, would go to Jones' post with ICAO.

It appears that whoever gets the appointment gets the CAB chairmanship, since no permanent chairman has been named by the White House for 1955.

New Committee Lineup

Newly elected Sen. Alan Bible, a close Nevada political associate of the late Sen. Pat McCarran, one of civil and military aviation's leading sponsors during his long Senate service, has been named to the Senate Commerce Committee. He is expected to participate actively in the committee's consideration of legislation revising the 1938 Civil Aeronautics Act.

Bible wasted little time in making himself known to Civil Aeronautics Board after being sworn in as a senator. He appeared as lead-off witness supporting the case of Ely, Nev., for regular air service. United Air Lines, which would be called on to furnish the service, is opposed to it.

Other new majority members on the Commerce Committee are: Sen. Price Daniel of Texas; Sen. Sam Ervin of North Carolina, and Sen. Strom Thurmond of South Carolina.

Sen. Mike Monroney seems likely to be named chairman of an aviation subcommittee of the Commerce Committee. Last year, he expressed opposition to Air Coordinating Committee's report, which he interpreted as meaning the eventual end of small air carriers and fostering monopolies in international air transport.

—Washington staff

the most competitive situations in the

the decision when standardization is to

AVIATION WEEK VOL. 62, NO. 3
JANUARY 17, 1955

Weapon System Contracting Clarified

AF Tells Primes: Stay in Own Backyard

- **Materiel chief says parts makers will be protected.**
- **USAF warns of police power to enforce policy.**

By Claude Witze

Aerial weapon system contractors have been told by Lt. Gen. Bryant L. Boatner, USAF Deputy Chief of Staff for Materiel, that the Air Force does not encourage or condone their entry into development and production of parts or subsystems normally supplied by other segments of the aircraft industry.

In an interview with AVIATION WEEK, Gen. Boatner said USAF has policing powers to enforce this doctrine and will use them where it feels the action is justified and necessary.

▶ **Congressional Charge**—Gen. Boatner, responsible for staff supervision of aerial weapon systems from development to delivery, outlined Air Force policy in contracting at a time when criticism has been mounting among component and subsystem manufacturers who fear invasion of their specialties by major airframe builders (AVIATION WEEK Dec. 27, 1954, p. 42; Jan. 3, 1955, p. 56).

At the same time, the House Small Business Committee said it favors a comprehensive congressional investigation of the weapon system concept. Reason: The committee fears "the major primes have used their new position to obtain engineering information in the guise of considering a subcontract only to use this data in the manufacturing of the particular item themselves."

Both small business firms and major component and subsystem manufacturers fear the weapon system concept will result in the cartellizing of major aircraft concerns.

Major points emphasized by Gen. Boatner in reply to the congressional and small business charges:

- USAF's most important policing tool is its jurisdiction over government-owned manufacturing facilities. These powers will be exercised to keep prime contractors from entering new fields. The weapon system concept does not relieve USAF from responsibility for supervision and control.
- Air Force must give top priority to the standardization problem in supervising weapon system development. This is essential to minimize the logistics burden in wartime.
- It is equally essential that USAF maintain its close contacts with component manufacturers in order to insure adherence to the timetables set by operational commands—such as Strategic, Tactical and Air Defense—in the face of progress by a potential enemy.
- Administration of Air Force Regulation 70-9, the formal statement that procurement will be made under the weapon system concept, is flexible. AFR 70-9 is a guide, but not a rigid one.
- It is in the interest of national defense to keep competent teams of development engineers and production experts intact when they have been organized by component manufacturers and thus have become eminent in the field.
- It is equally important to national defense to keep production facilities scattered, along with the skills and talents to make them work.

▶ **R&D Factor**—Gen. Boatner believes the fear of component manufacturers that prime contractors will expand into their fields basically goes back to the competitive spirit natural to American industry.

"I realize," he said, "that there will always be some dissatisfaction voiced in an industry as highly competitive as this. The dissatisfaction is regrettable and not always justified. But the competitive condition is good. It should foster inventiveness and ingenuity that will give us advanced weapons at reasonable cost."

This inventiveness and ingenuity, Gen. Boatner said, is vital to USAF research and development. And R&D, he added, is "far and away" the most important single factor to the future of the Air Force.

▶ **U. S. vs. Russia**—"We are doing everything we can to stimulate the flow of new ideas," he said. "It is essential, and the industry, highly competitive itself, should take satisfaction from the fact that it is helping the Air Force meet its competition.

"The Air Force is engaged in one of

Small Business Percentage

The weapon system concept is not a threat to small business and the Air Force is determined to maintain a "proper percentage" of subcontracting work available to small firms, says Lt. Gen. Bryant Boatner, USAF Deputy Chief of Staff for Materiel.

Gen. Boatner told Aviation Week he recognizes that many small contractors, those with fewer than 500 employes, fear that prime contractors will make more components and parts than they have been supplying for many years past.

"I feel," he said, "that this concern comes out of a false impression that the weapon system concept allows the weapon system contractor the license to determine whether equipment or components shall be subcontracted or produced by the weapon system contractor himself.

"The weapon system procurement concept, as stated in AFR 70-9, and the Air Force policy for small business, as spelled out in Air Force Procurement Instruction 51-102, do not afford the weapon system contractor any such latitude of operation.

"Under the policy of AFR 70-9 the Air Force still relies mainly on direct contracting between the Air Force and the equipment industry for supply of certain equipment to the weapon system contractors."

Gen. Boatner said that under AFPI 51-102, the USAF contracting officer can make sure that small business gets a full opportunity to participate, so long as it is consistent with the need for satisfactory performance.

"The Air Force is greatly concerned that a proper percentage of subcontracting work be maintained," the general said.

"Results of recent surveys show there has been no falling off in the percentage of the Air Force dollar going to small companies either in the form of subcontracts from prime contractors or contracts with USAF."

the most competitive situations in the world today. Consider the possibility that the Soviet Union might develop and produce better air weapons than ours."

The weapon system concept, Gen. Boatner said, is a policy selected by the Air Force to help it meet this competition.

Giving a single prime contractor responsibility for the airplane, with all the related ground and air equipment, supporting facilities and services, is no departure from the normal Air Force aim, the general added.

"It represents a re-emphasis of the intent to provide for the timely attainment of new systems that are ready for combat when produced."

▶**No Illusions**—Gen. Boatner indicated that some Air Force officers believe industry shows signs of complacency in spots where USAF cannot afford to be complacent.

He pointed out that in order to "wring the best effort out of industry," it is vital to stimulate new approaches and new ideas.

He made it clear that USAF appreciates the many new and valuable ideas contributed by the components industry. For this reason, AFR 70-9 provides insurance for capitalizing on the talent, skill and productivity of the components industry.

▶**Procurement Guide**—Gen. Boatner outlined for AVIATION WEEK several interpretations of AFR 70-9. According to the general:

- It places added responsibility on the prime contractor to make sure the airframe and its components are compatible and integrated to form an air weapon system that will do the job. It does not matter whether a component is contractor or government-furnished. The prime contractor must see that it will work in the total system.
- It emphasizes to the equipment and component industry the importance of close coordination with both the prime contractor and USAF. The equipment and component makers must consider the demands of the total system and assume a fair share of responsibility for their products.
- It provides a method under which the weapon system contractor drafts the performance specifications and the component manufacturer drafts the detailed specifications for building the item. In the development of components, this has been a trouble area because of the volume of work and uncertainties about the "state of the art."

For uneasy component manufacturers, Gen. Boatner continued with a list of things AFR 70-9 does not mean.

The general said:

- It does not mean a prime contractor is authorized to develop and procure all components for a weapon system. AFR 70-9 is a "firm guide" in this respect, and deviations to it are made only when circumstances dictate.
- It does not mean a prime contractor is expected or licensed to undertake the development and/or production of components normally provided by other manufacturers.
- It does not mean a prime contractor will reduce his subcontract structure or in any other way reduce the participation of other elements of the industry in a given air weapon system program.
- It is not a relinquishment of Air Force responsibility to supervise and control the development and production of air weapon systems. USAF maintains close supervision and control over all aspects of system development and production, primarily through the weapon system project offices (WSPO).

BOATNER: A highly competitive industry.

In addition to control over government-owned manufacturing facilities—tools as well as plants—USAF has other policing powers. This includes terms of the contract, approval of specifications while the weapon system is being designed and developed, periodic inspections carried out at the contractor's plant, and the influence that can be exercised by the administrative contracting officer, the weapon system project offices, the local plant USAF representative and the weapon system phasing group.

▶**Major Headache**—Gen. Boatner emphasized standardization as a major USAF headache.

"In insisting on standardization," he said, "we realize that a degree of judgment is needed, yet it remains a fact that anarchy in this area can result in chaos. That is why we must retain control. Actually, our standardization effort is carried out at the laboratory level.

"But the lab man does not make the final decision. He offers advice to the WSPO and that office confers with the prime contractor. Jointly, they make the decision when standardization is to be followed. . . .

"We recognize, of course, that today's air weapons place a premium on getting the maximum performance with minimum space and weight. This tends to give us highly specialized components. But USAF's operational capability could be cut to pieces by the overloading of our logistics system and the increased training requirements.

"These factors make standardization vital whenever it will not hurt combat performance and USAF must continue to emphasize standardization in the weapon system concept."

▶**USAF Responsibility**—Gen. Boatner urged industry to recognize this major problem and make sure it is considered at high management levels. But he accepted a large part of the job for USAF.

"The Air Force must carry the basic responsibility of components between specific weapon systems," he said, "because such action cannot logically be contracted. I know standardization will be hard to achieve between weapons vastly different in performance.

"But we can and must get it to a reasonable degree on components and short-lived sub-systems between weapons of similar environment and performance."

▶**Flexibility Goal**—In addition to standardization and the continued flow of new ideas, Gen Boatner named a third major goal that USAF must achieve in its procurement policies. It is flexibility, the ability to "change the way we are doing things when we find results are not what they should be."

Prime reason for this, he said, is the importance of time to USAF in all its operations.

Gen. Boatner pointed out that Strategic Air Command and Air Defense Command, for example, never can delay about going into action.

"In case of attack," he said, "they must be ready to go and we intend that the weapon system concept will help give us that readiness. The whole weapon system must be ready to work. It also must be ready to move to another base of operations and work from there.

"The Air Force must know exactly when a weapon will be in inventory and operational. It may be that the date is not good enough in view of what we know about the potential enemy's plans and state of his equipment.

"In this case, flexibility is vital because we may have to alter our program to get a certain weapon in operation before it is too late. Here is where USAF is in a race with its competition and needs the help of both airframe and component manufacturers."

▶**Teamwork**—Gen. Boatner predicted that the future also will see more em-

phasis on coordination and teamwork between all segments of the aircraft industry and the Air Force.

"We have in various stages of design and development new weapon systems far exceeding the weapons of today in performance and complexity.

"We must continue to improve our methods and procedures in cooperation with industry to obtain these new weapons on a timely and economical basis.

"It will take effort and cooperation between industry and USAF to do it. That's the only way to get and maintain an Air Force capable of doing its job."

New Rules on Patents Go into Effect in April

Revised Armed Services Procurement Regulation on patents (Part 1, Section 9) are expected to take effect in late April of this year.

Principal changes, three years in preparation, are:

- Elimination of the regulation providing for title to patent rights under specified conditions.
- Elimination of the requirement for reproduction rights license under background patents.
- Substitution of a prohibition against negotiating for rights under background patents that have been reduced to practice as an incident to the procurement of supplies or services.
- Changes in the reporting of royalties, excusing contractors from reporting those of less than $250.

A new provision authorizes a military department to obtain patent rights when it is providing substantial financial support for a product improvement program.

Treatment of patent indemnity has been made more complicated in order to provide greater flexibility and reduce the amount of indemnity.

Terms of the new rules are being studied by the Patent Committee of the Aircraft Industries Assn. AIA said it was too early to comment on the rules but that some criticism is expected in the near future.

Much will depend, AIA said, on interpretation of the section in future contracts.

Navion Inspections

All Ryan Navions must be inspected for fuselage frame cracks by Mar. 15 to comply with an airworthiness directive issued by Civil Aeronautics Administration.

Inspection is being required as the result of cracks found in some Navion fuselage frames at Station 294.1, inboard from top stringer cutouts.

Congress to Probe Military Airlift

Democratic majority will question adequacy of USAF transport section during review of defense program.

By Katherine Johnsen

Inadequacy of military airlift will figure prominently in the new Democratic Congress' review of the Administration's defense program, certain to be a major business of this session.

Important activity on civil aviation also is expected, starting off with consideration of an appropriation for airline subsidies in a few weeks.

The scheduled airlines will aim for legislation defining the roles of irregular and charter carriers.

Railroads will raise the issue of transporting surface mail by air in connection with legislation increasing postage rates. The Administration wants first class postage increased from three to four cents and airmail from six to seven cents.

► **Democratic Views**—On the defense program, the basic contention of Democratic leaders is that the Administration is weakening the capability to meet "fringe war" challenges in cutting Army and Marine Corps manpower. They talk of the possibility of an atomic "stalemate," and the prospect that ground forces may be called on to meet communist encroachments. Even such strong advocates of strategic air power as Sen. Stuart Symington, former Secretary of the Air Force; Sen. Mike Monroney and Rep. John McCormack now warn against reducing ground forces.

Along with this apprehension goes the Democratic concern over airlift for the transport of troops to critical areas. Air Force's airlift wings were reduced from the 17 planned under the Truman Administration's 143-wing program to 11 under the Eisenhower 137-wing program. A few Democrats mention the possibility of transferring airlift responsibility from the Air Force to the Army.

Other phases of the defense program expected to be reviewed:

- **Research and development.** Democrats seem satisfied with the Administration's 137-wing USAF program (aside from the elimination of airlift wings) as a minimum force. Their skepticism is over insufficient emphasis on research and development to sustain "quality" in the force.

A subcommittee of the House Government Operations Committee, to be headed by Rep. Chet Holifield, will continue its investigation of the organization and administration of military R&D programs.

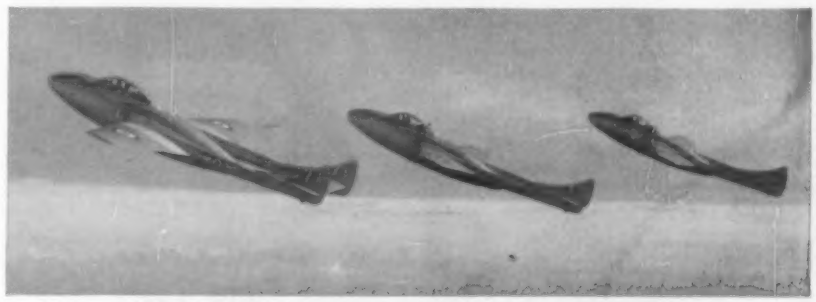
Under the chairmanship of Rep. R. Walter Riehlman last year, the subcommittee called for increased participation by civilian scientists and complete separation of R&D activities from procurement activities (AVIATION WEEK Aug. 9, 1954, p. 15). Under the direction of Assistant Secretary of Defense for Research and Development Donald Quarles, Defense Department is preparing a comprehensive reply to the subcommittee's recommendations.

- **Guided missiles.** Some top Democrats do not believe there is enough "push" behind the guided missiles program.

As a basis for their review, there will be the report of the Defense Department committee, headed by Assistant Defense Secretary (Applications Engineering) Frank B. Newbury.

Last year, the Senate Appropriations Committee directed the review after finding "a disorganized situation" in the missiles program. Deadline set for the report was Jan. 15.

- **Small business in defense.** Both House and Senate Small Business Com-



RAF Starts New Training Course

This trio of two-place de Havilland Vampire T. 11 trainers is from the Royal Air Force school at Oakington, which has inaugurated a new pilot indoctrination plan in which students fly the piston-engine Percival Provost and jet Vampire. Jet also can be used for combat schooling. It has side-by-side seats and interconnected gyro gunsights.

mittees plan to go extensively into the effect of procurement policies on small firms.

The Senate committee expects to hold hearings on Defense Secretary Charles Wilson's recent procurement directive (AVIATION WEEK Dec. 27, 1954, p. 15). Presented by Defense as an action to strengthen the mobilization base, the directive was interpreted by the committee's ranking Republican as setting up a list of preferred firms to receive "the bulk of defense contracts."

The House committee will go into the effect of USAF's weapon system concept on small firms (see p. 13).

► **Piecemeal Legislation**—The Administration's approach to transportation legislation will be piecemeal to meet specific situations. The President's Cabinet committee has failed to reach agreement on an overall Administration policy resolving the many issues in controversy among the different forms of transportation.

With the departure of Commerce Undersecretary for Transportation Robert Murray, the Administration is not expected to press for implementation of the recommendations of the Air Coordinating Committee's report.

Concerning the review of transportation policy by the Cabinet committee, headed by Commerce Secretary Sinclair Weeks, the President observed in his State of the Union message: "This is the first such comprehensive review ever undertaken directly by the executive branch of the government in modern times.

"We are not only examining major problems facing the various modes of transport. We are also studying closely the interrelationships of civilian and government requirements for transportation. Legislation will be recommended to correct such policy deficiencies as we find."

► **Air Law Review**—Other aspects of the outlook for civil aviation include renewed efforts to rewrite civil aviation law.

Chairman Warren Magnuson of the Senate Interstate and Foreign Commerce Committee indicated that his group would continue the general review of aviation law, started a year ago with hearings on the omnibus bill introduced by the late Sen. Pat McCarran.

Air Transport Assn. will press for amendments to the 1938 Civil Aeronautics Act defining the certificate requirements for irregular operations and charter operations and clarifying federal jurisdiction over economic and safety aspects of civil aviation.

► **Opening Pressure**—Congress put pressure on Civil Aeronautics Board in the opening days of the session. Actions included:

• Creation of a special five-man committee to investigate the Board was proposed by Rep. Hale Boggs of New Orleans, continuing the attacks of the Louisiana delegation over the failure to obtain New Orleans-Mexico City service. Chairman Percy Priest of the House Interstate and Foreign Commerce Committee told AVIATION WEEK that any such investigation would be a matter for his group to undertake, rather than a new committee specially created for the purpose.

• The Washington state delegation, led by Magnuson, decided to demand re-certification of the four airlines now serving Alaska from the Northwest. "We will not settle for anything less," he declared.

Local service airlines again this year will launch a drive for permanent certification of the 14 existing carriers. Last year, the House passed and the Senate Commerce Committee approved, the legislation. Rep. Carl Hinshaw (R., Calif.) was first to re-introduce a permanent certification bill this session.

Other matters scheduled for congressional action:

• **Aviation gasoline tax.** This is scheduled to drop from two cents to 1.5 cents a gallon Apr. 1, but the President has asked that the higher rate be continued.

• **Defense emergency powers.** The Administration wants authority to establish priorities and allocations and to promote the expansion of facilities by guaranteeing loans continued beyond the expiration date June 30.

• **Postal rate-making.** The Administration wants an independent board created to set postage rates and balance postal deficits with revenue. Although there is strong support for this, Congress always has balked at surrendering this prerogative in the past. Rep. Katharine St. George has introduced legislation setting up the independent board.

• **Government administration.** The Commission on the Organization of the Executive Branch, headed by former President Herbert Hoover, shortly will start submitting a series of reports. Those of interest to aviation will deal with: legal services and procedures, defense contracting policies and procedures, organization of military research activities and military transportation activities.

Bricker Revives Civil Aviation Law Rewrite

Nonscheduled and contract airlines would be brought under closer economic regulation by Civil Aeronautics Board under legislation introduced by Sen. John Bricker, ranking Republican and former chairman of the Senate Interstate and Foreign Commerce Committee.

Bricker's bill is the outgrowth of lengthy hearings held last year on a 177-page bill rewriting civil aviation law introduced by the late Sen. Pat McCarran, an author of the 1938 CAA act. It probably will be the basis for hearings this year before the subcommittee on civil aviation.

► **Certificate Requirement**—Under the Bricker measure, large irregular carriers would be lumped with scheduled airlines as "air carriers" and required to obtain certificates at CAB proceedings. Only operators of aircraft of less than 12,500 lb. would be exempted from the certificate requirement.

The Board would have one year after enactment to determine which irregu-

British Auster Passes Army Field Tests

Auster A.O.P. Mk. 9, liaison plane for the British army, approaches a rough stubble corn field during recent intensive tests to establish the craft's ability to operate under active service conditions. A five-pilot team continuously flew the Auster during poor weather into and out of the unprepared field crisscrossed with ridges and ruts. Operation and maintenance identical to army methods were duplicated during the 150-hr. trials.

beam can be deflected at any desired

lar operators to certificate and for what type of operation.

Contract airlines would be required to obtain licenses from CAB and would be subject to Board economic regulation, including minimum rates. At present, there is no economic regulation of this type of carrier.

▶ **Feeders, Freighters**—Other important provisions of the Bricker bill:

• CAB would be required to grant permanent certificates to local service airlines meeting standards of fitness and public convenience within 120 days after enactment.

The measure does not provide for permanent certification of certificated all-cargo airlines, as did legislation approved by the Commerce Committee last year. Since then, the future of the cargo carriers has become dubious, with the failure of Slick Airways and Flying Tiger Line to work out a merger arrangement.

• All bilateral executive agreements, exchanging air rights with foreign governments, would have to be filed with the Senate within 30 days after negotiations are completed.

• The executive action separating airmail payments from airline subsidies would become law. Only carriers certificated to transport mail, under the Bricker measure, would be eligible for subsidies.

The Board would be required to "take into consideration" rates paid to foreign air carriers—or Universal Postal Union rates—in establishing the service mail rates of U. S. international carriers. The UPU rates are substantially higher than the rates the Board has set for U. S. carriers.

Bricker rejected a complete rewrite of civil aviation law and a far-reaching reorganization of the government agencies handling aviation, as proposed in the original McCarran bill.

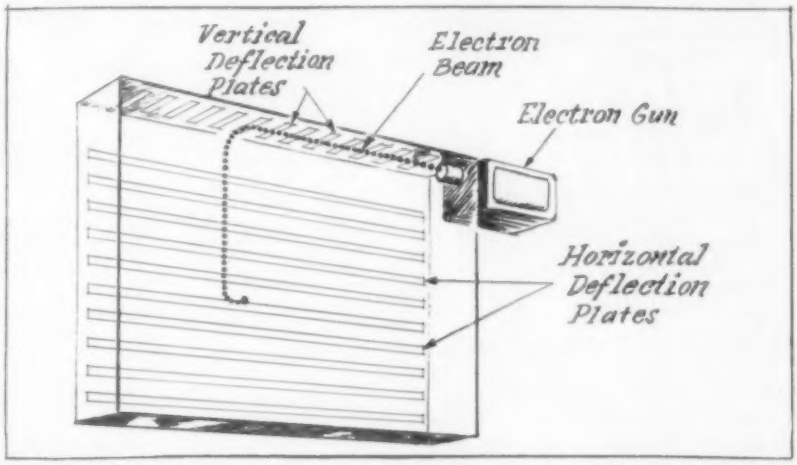
"After studying the entire record before the committee," Bricker said, he found "no reason to disrupt the air transport industry with a reorganization of the federal agencies dealing with aviation or to replace the Civil Aeronautics Act of 1938 with an entirely new organic act."

Army Starts Copter Training Program

Training program for Army helicopter units has been started with the activiation of two transportation battalions, one based at Ft. Sill, Okla., the other at Ft. Riley, Kan.

Army pilots for the two units will receive their wings at Camp Rucker, Ala., take transition training on larger cargo and transport types of copters at Sill and Riley. The Piasecki H-21 is being delivered to the two units.

FLAT PICTURE TUBE, developed by Willys Motors, is key to Navy's radically new cockpit instrument display aimed at simplifying flight training. Tube shown is a laboratory model.



ELECTRON BEAM, introduced at side, is positioned on the flat tube's screen by applying voltages in a proper sequence to a series of vertical and horizontal deflection plates.

Flat Tube Will Simplify Cockpits

Navy last week took the wraps off a revolutionary integrated cockpit instrument display that uses a radically new flat picture (TV) tube and is expected to cut pilot instrument training time by 75%.

The new flat tube, developed by Willys Motors, Inc. (AVIATION WEEK Jan. 10, p. 11), and a cockpit mockup of the new integrated instrument display were shown for the first time to airframe industry representatives at Douglas Aircraft Co.'s El Segundo plant.

Sponsored by the Office of Naval Research and Bureau of Aeronautics, the new cockpit display is expected to fly in an experimental aircraft in 1958. Another portion of the same program is aimed at reducing the control system to two basic controls: a control stick and a throttle.

▶ **Everything on Flat Tubes**—Information now displayed on a multitude of individual panel instruments is expected to be displayed on two flat picture tubes:

• **Vertically mounted** semi-circular flat tube, located directly in front of pilot, will display altitude, speed and aircraft pitch and bank attitude information plus physical terrain features such as mountains—depicted artificially.

The display will be transparent so as not to interfere with the pilot's forward vision during contact flight.

• **Horizontally mounted** flat tube, below the first and just inside the cockpit rim, will present the broad physical features of the earth below in a manner somewhat similar to that of a conventional radar map.

This horizontal display also will show necessary navigation and traffic control information plus distance to base, fuel remaining and similar data.

Switches will enable the pilot to select and display only the information needed at the time, for such situations as takeoff, cruise, landing, etc.

▶ **Willys Tube the Key**—The new instrument display is made possible by the new flat picture tube, a proprietary development of the Electronics Division

Civil Aircraft Shipments Drop

Civilian aircraft shipments, measured by airframe weight, declined 36% in October from the previous month, the Department of Commerce reports. Combined weight of the 174 planes shipped during October totaled 577,110 lb.

Unfilled orders Oct. 30 for civil planes of 3,000 lb. airframe weight and over amounted to 251.

	October	September 1954	October 1953
Completed aircraft	174	265	235
By weight of airframe			
Less than 3,000 lb.	155	234	208
3,000 lb. and more	19	31	27
By number of places			
1 to 5 place	147	212	208
More than 5 places	27	53	27
By total hp., all engines			
Up to 339 hp.	145	208	209
400 hp. and more	29	57	27
Total value of completed parts (000 omitted)	$25,409	$36,542	$28,487
Aircraft	16,849	26,336	20,236
Less than 3,000 lb.	3,194	4,400	2,034
3,000 lb. and more	13,655	21,936	18,202
Aircraft parts	8,560	10,206	8,251
Total aircraft engines and parts (000 omitted)	11,869	9,511	15,489
Aircraft engines	4,811	3,352	8,083
Engine parts	7,056	6,159	7,406

Willys Motors, wholly owned subsidiary of Kaiser Motors Corp.

It has many other important military (and commercial) applications, including use for air defense and air traffic radar plotting boards.

Although several established electronics-television manufacturers are known to have started developments aimed at flat tubes, Willys is the first to disclose a working model. Experimental models of the new Willys tube have been operating for nearly a year in the company's West Coast electronics lab, now located at Palo Alto, Calif., AVIATION WEEK has learned. The tube was invented by William R. Aiken, director of research at the Willys lab and formerly with the University of California's radiation lab.

► **Big Picture**—Willys has built experimental tubes with a picture area equivalent to a conventional 24-in. TV tube; but thickness is only three inches, compared to a depth of 20 in. for a conventional picture tube.

The company has "ideas on how to make the picture extremely large" and for reducing tube thickness, a Willys spokesman says.

Unlike many flat tube developments, which reportedly use an elaborate grid-matrix, the Willys tube employs the familiar electron gun and beam used in conventional TV picture tubes. The electron beam is compressed by powerful focusing action inherent in the tube's design, giving very high definition and brightness. The tube can operate at 2,000 line definitions, considerably better than present commercial TV standards of 525 lines, Willys spokesmen say.

► **How It Works**—For competitive and patent reasons, Willys officials are tight-lipped about full details on the new flat tube's principles of operation and construction. However, the company officials have released the following description to AVIATION WEEK:

The tube consists of a phosphor screen sandwiched between two rectangular glass plates. The entire unit is sealed and evacuated. New transparent film-type phosphors, such as those recently announced by General Electric (AVIATION WEEK Dec. 27, 1954, p. 11), enable pilot to look through the tube.

► **Electrostatic Deflection**—An electron gun injects a beam along a horizontal edge of the tube (see sketch on p. 17). The electron beam flows undeflected in a field-free region adjacent to a row of vertical deflection plates mounted transversely along the edge of the tube.

By controlling the voltages applied to the vertical deflection plates, the beam can be caused to bend down at any desired position across the tube. The electron beam then flows vertically in another field-free region past a series of horizontal deflection plates.

By applying appropriate voltages to these deflection plates, the electron beam can be deflected at any desired height toward the front phosphor screen, positively charged to attract the beam. Wherever the beam hits the screen, it creates the familiar blips of light that collectively make up the picture.

Thus by changing the voltages on the horizontal and vertical deflection plates in suitable sequence, the electron beam can be caused to scan the front face of the tube in much the same way as a conventional picture tube. The circuitry involved in this sequence switching is moderately complex at present, but Willys engineers hope to simplify it.

► **Unanswered Questions**—This basic explanation of the new tube's operation undoubtedly omits certain refinements that Willys will keep under cover until it has obtained patent protection.

For instance, where a transparent picture tube is required, Willys says transparent horizontal deflection plates are used but does not disclose their nature.

Some observers also speculate that other auxiliary deflection systems may be necessary to provide the required linearity. —PK

AF to Increase Jets In Reserve, Guard

More jet strength for Air Force Reserve and Air National Guard units is planned in a revision of USAF's long-range reserve forces program.

Ultimate goal: 24 combat wings in the Reserve, 27 in the Air Guard. Of the 51 wings, 32 will be jet aircraft—broken down into nine fighter-bomber wings in the Reserve and 23 fighter-interceptor wings under National Guard supervision.

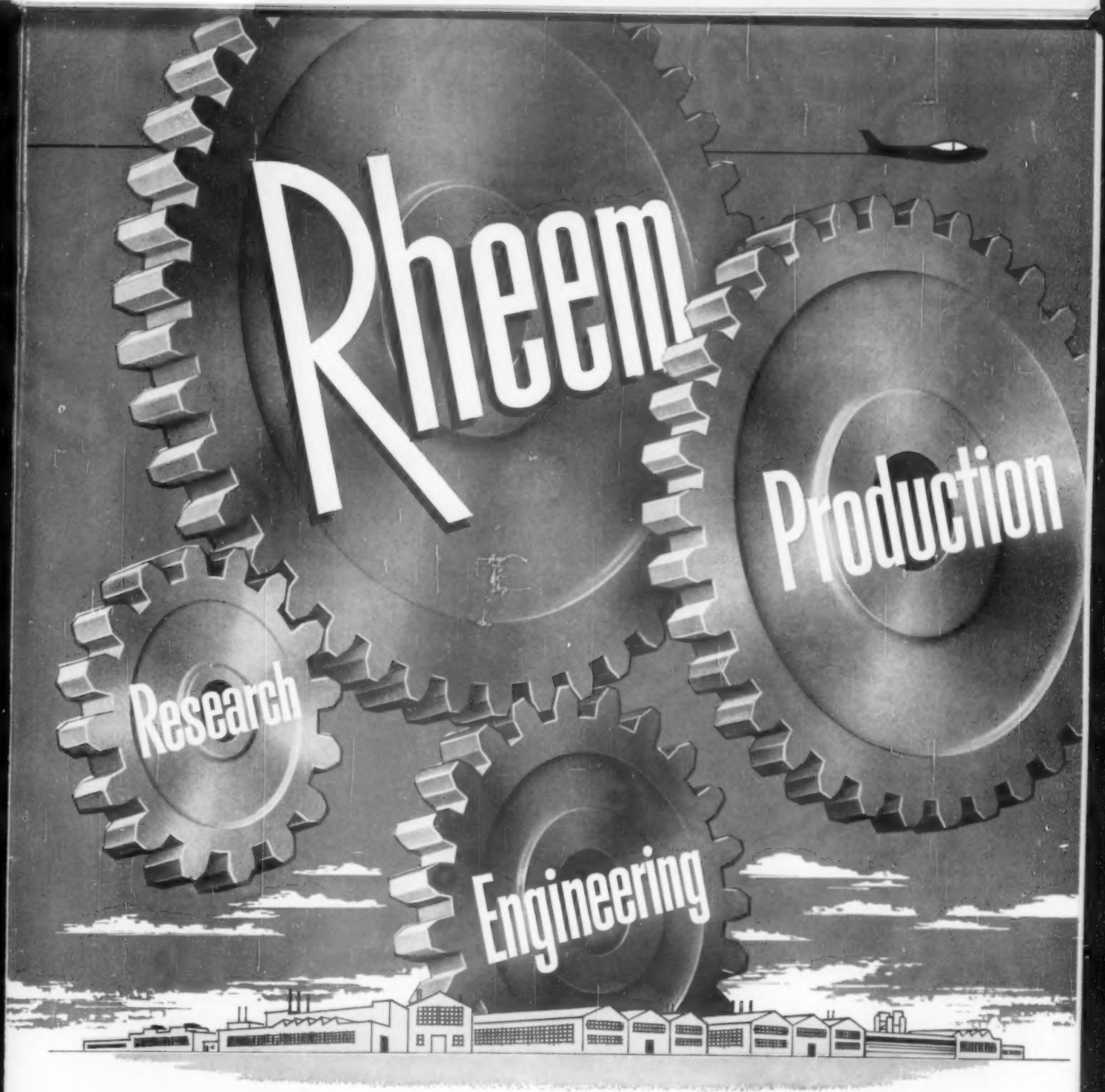
This is an increase of one wing for the Air Force Reserve, which now consists of nine troop-carrier wings, six fighter-bomber wings, two tactical reconnaissance wings and six training wings.

Under the new setup the Reserve will have, in addition to the nine fighter-bomber wings, 13 airlift wings and two tactical bomber wings.

The Air National Guard, already at 27-wing strength, now has 17 fighter-bomber wings, six fighter-interceptor wings, two tactical reconnaissance wings and two light bombardment wings. Future goal is to center the activity in 23 fighter-interceptor wings, supported by two tactical bomber wings and two tactical reconnaissance wings.

Both branches of the service also will have necessary support units.

Present total aircraft strength of the Reserve is about 600 planes of all types. The Air Guard has about 2,000, more than a third jet-propelled. Pilot strength is 3,500 for the Reserve and 2,700 for the National Guard.



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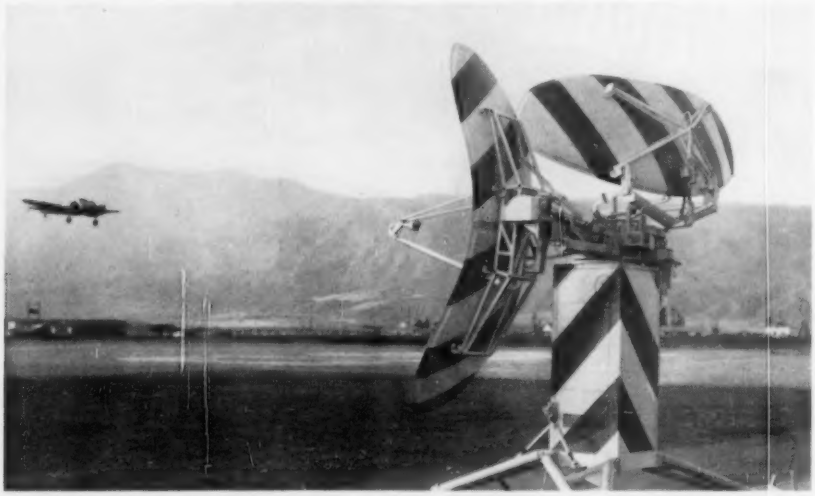
AVIATION EXPERTS FROM AROUND THE WORLD SEE GILFILLAN GCA QUADRADAR DEMONSTRATED

Representatives of the Royal Canadian Air Force, the Royal Australian Air Force and the United States Air Force were among the many groups attending the field demonstrations of the new Gilfillan GCA Quadradar during November-December, 1954. Also witnessing the performance of the perfected equipment during this period were authorities from the French Air Force; the Spanish Air Force; the International Civil Aviation Organization, representing 63 countries; all Commands of the United States Air Force; United States Navy BuShips, BuAer and CNO; and the Civil Aeronautics Administration.



Over 200 aviation authorities attending the recent field tests agree the Gilfillan GCA Quadradar more than fulfills advance predictions of remarkable versatility. Arousing most comment was the clear demonstration that the new 4-in-1 equipment enables a single operator to handle multiple aircraft in a complex traffic pattern including emergency landings. Favorable comment also included the greatly increased definition and expansion of the precision approach display afforded by the new Beta Scan Azel scope developed by Gilfillan; instant rotation of antennas to serve desired runway remoted to operator's position; built-in circular polarization, eliminating rain and snow clutter; and, with the height-finding display, the location and checking of jet aircraft at 47,000 feet. The United States Air Force is now completing evaluation tests of the new equipment.

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Gilfillan
LOS ANGELES
AROUND THE WORLD

CRASHWORTHINESS of DH Dove cabin saved passengers from crushing forces of 35-deg. nose-down impact reaching 26.3G. However, crew was killed when plane's nose collapsed.

Aircraft Safety Team Proposes . . .

How to Design for Crash Survival

Aviation Crash Injury Research specialists have proposed important new yardsticks for designing aircraft structures and seats to increase the chances of walking away from survivable accidents.

The Av-CIR investigators recommend the design standards in a case history of the crash of a de Havilland Dove twin-engine business plane.

► **Realistic Requirements**—For the first known time, the specialists say, the magnitude and direction of the principal crash load in combination with the duration of the force has been calculated. With such data, they say engineers can set up realistic requirements for dynamic tests of structures and seats.

A. Howard Hasbrook, leader of Av-CIR's team, explains that engineers have been handicapped in designing for crash load factors by a lack of adequate load data, and have relied on flight and landing load requirements, plus experience and intuition. Seat design has been influenced largely by application of static load tests and the ability of the structure to take this force without failure.

Av-CIR's experience shows there are wide variations in the effects of static vs. dynamic loads on aircraft, seat and human structures.

► **Recommendations**—These are factors the Aviation Crash Injury Research team recommends that engineers account for in designing for crashworthiness:

SEATS AND BELTS:

• These deceleration-time-direction-velocity factors for dynamic tests: Impact deceleration of 10-50G; impact duration, 0.02-0.10 sec.; impact directions, 30 deg. above, below and to the side of the aircraft's longitudinal axis; impact velocities, 50-100 mph. Include the mass factor of two 170-lb. occupants to provide typical kinetic energy effects.

• Use forward load factors equal or exceeding the static load loop holding capacity of the safety belt—a minimum

SIDE FAILURE of seat (left) blocked aisle, impeding exit. Note intact cabin.

REAR CROSS TUBE of seat failed under impact of aisle seat attach bolt.

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Code for Crash Investigations

Aircraft engineers, seeking data on aircraft crashes, have been severely handicapped by the lack of a coding system in crash investigation reports. They need a system that can tell them pertinent facts about the accident quickly instead of having to wade through a vast mass of material.

A. Howard Hasbrook, associate director of Cornell-Guggenheim Aviation Safety Center and Aviation Crash Injury Research, has taken an initial step in easing this burden by reducing to a code a comprehensive evaluation of an accident.

The code, used for the first time on Av-CIR's report on the de Havilland Dove crash, consists of these factors:

P_a—Pitch (nose) angle of aircraft in relation to horizontal.

R_a—Roll (wing down) angle in relation to horizontal (L-left wing; R-right wing).

FP_a—Flight path angle of plane in relation to horizontal.

T_a—Terrain angle in relation to horizontal.

Imp_{axv}—Impact angle in relation to plane's longitudinal axis in the vertical plane.

Imp_{axh}—Impact angle in relation to plane's longitudinal axis in the horizontal plane.

Imp_v—Impact velocity, mph.

M—Mass struck by plane; type and hardness (grd.-ground, sft.-soft, hrd.-hard, wtr.-water, dp.-deep, shlw.-shallow, bldg.-building, cmt.-cement, brk.-brick, frm.-frame, rnwy.-runway, aspt.,-asphalt, sd.-sod, etc.)

Imp_d—General directions of the principal impacts in relation to the aircraft (F-front, R-rear, LS-left side, RS-right side, T-top, B-bottom).

$Imp^1{}_g$—Magnitude of first, principal impact, in Gs.

$Imp^2{}_g$—Magnitude of second impact in Gs.

$G^1{}_t$—Duration of first impact in seconds.

$G^2{}_t$—Duration of second impact in seconds.

Cpt—Cockpit.

C_f—Cabin, forward area.

C_c—Cabin, central area.

C_r—Cabin, rear area.

NS—Non-survivable, in relation to structural damage.

Svb—Survivable in relation to structural damage.

F—Fatal.

S—Survivor.

O—No occupants.

FR—Fire (N-none, Y-yes.).

UNK—Unknown.

Thus on the front cover of the Aviation Crash Injury Research investigation of the de Havilland crash is the following legend:

(P_a −35°) (R_a −40°R) (FP_a −50°) (T_a ±5°) (Imp_{axv} −15°) (Imp_{axh} L20°) (Imp_v 95 mph.) (M Grd. Sft.) (Imp_d F.R.) ($Imp^1{}_g$ 26.3) ($g^1{}_t$ .055') ($Imp^2{}_g$ Unk.) ($g^2{}_t$ Unk.) = (Cpt NS 2F) (C_f Svb O) (C_c Svb O) (C_r Svb 2S (FR N).

of 3,000 lb. or 17.5G for each person.

• Design seats and anchorages to deform appreciably and absorb energy under crash loads prior to ultimate failure.

• Delethalize portions of seats that are within striking range of the head and body.

STRUCTURE:

• Account for fore and aft longitudinal loads from points 30 deg. above, below and to the side of the plane's longitudinal axis.

• Design cockpit structure to resist complete collapse in survivable crash landings in which the nosedown impact angle is not more than 15 deg.

• Design fuselage structure for progressive buckling and optimum energy absorption.

• Use flooring that fails by deformation and buckling rather than by fracturing.

• Design flooring, to which seats are attached, as a "platform" whose ultimate strength equals or exceeds that of the primary fuselage structure.

• Lower fuselage structure should resist collapse in wheelsup or low-angle crash landings so as not to destroy basic floor structure and seat anchorage.

• Design engine mounts to deform and transmit some crash energy to wing structure prior to failure of the mounts.

• Design wings to fail outboard of the fuselage so as not to damage the adjacent cabin and floor structure.

CABIN:

• Delethalize interior cabin portions that are within striking range of the head and body.

• Design readily operative emergency exits, regardless of fuselage distortion.

• Design passenger door and emergency panel unlocking mechanisms to allow natural, one-hand operation.

• Provide a minimum of operating instructions for door and emergency exits and use large lettering for easy reading under adverse lighting.

• Store fire extinguishers and emergency evacuation tools in both ends of the passenger cabin.

▶ **The Accident**—The de Havilland Dove crash, which provided Av-CIR

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with its first knowledge of duration of impact forces as well as magnitude and velocity, occurred Dec. 9, 1952, at Staten Island (N. Y.) Airport during a sales demonstration flight.

The pilot made a single-engine approach to the field with the right propeller feathered. At approximately 20-ft. altitude, two-thirds down the runway, he started a single-engine "go-around." At 50 ft., the landing gear was retracted, flaps were set at 20 deg.

A few seconds later, during the climbout, the pilot tried to restart the right engine. As the prop began to rotate, the Dove nosed up suddenly, stalled and rolled off to the right.

Cutting through small trees, the plane hit soft ground with the nose down about 35 deg. and the right wing down approximately 40 deg. Yaw angle was 20 deg. to the right. The right wingtip struck first, quickly followed by the nose and cockpit. Impact speed was calculated to be about 95 mph.

The right wing's outboard section crumbled and the wing and cockpit collapsed to the right and rearward to the wing center section as the plane hit, bounced and cartwheeled approximately 180 deg. on its vertical axis. A second and final impact occurred as it hit heavily on its belly and slid backward to a halt.

FLOOR COLLAPSE popped seats free in forward cabin. Wall attachment failed.

The pilot and co-pilot suffered fatal injuries; the two passengers, in forward-facing seats in the rear of the cabin, sustained only minor bruises.

► **Crash Loads**—Hasbrook reports that the Dove's first crash impact was approximately 20 deg. to the left and 15 deg. below the plane's longitudinal axis. As the crash "progressed," the fuselage pitched up slightly and the impact force ranged from 15 deg. below the longitudinal axis to 30 deg., disintegrating about 8½ ft. of the nose structure.

He calculates that the plane decelerated from 95 mph. to about 44 mph. during the first contact, implying a force of 26.3G in the intact portion of the passenger cabin. Analysis indicates this force lasted about 0.055 sec.

After bouncing, the Dove cartwheeled, turned 180 deg. and slid backward to a stop; the left wing was down 5-10 deg. and the tail yawed slightly to the left as viewed from the nose. Impact speed was about 20 mph. The crash force here was imposed from the rear, slightly from the left and about 25 deg. below the longitudinal axis of the cabin.

During the second contact, the two rear passenger seats failed downward, to the rear and to the side.

Using known static test load data for the seats, and the absence of injury, it is estimated that the second impact generated a force exceeding one or more of these loads: 4.8G downward, 1.8G sideward, 1.8G backward, with peak lasting about 0.02 sec. Average longitudinal deceleration during the slide backward was approximately 0.6G for about 1½ sec.

► **Damage**—The cabin structure, particularly aft the front spar, proved to be highly crashworthy, Hasbrook finds. Collapse of the right wing, without damaging the cabin structure adjacent to the wing root, also implies a desirable design concept, he says. Lack of passenger injury shows the seats and cabin walls were of a delethalized nature.

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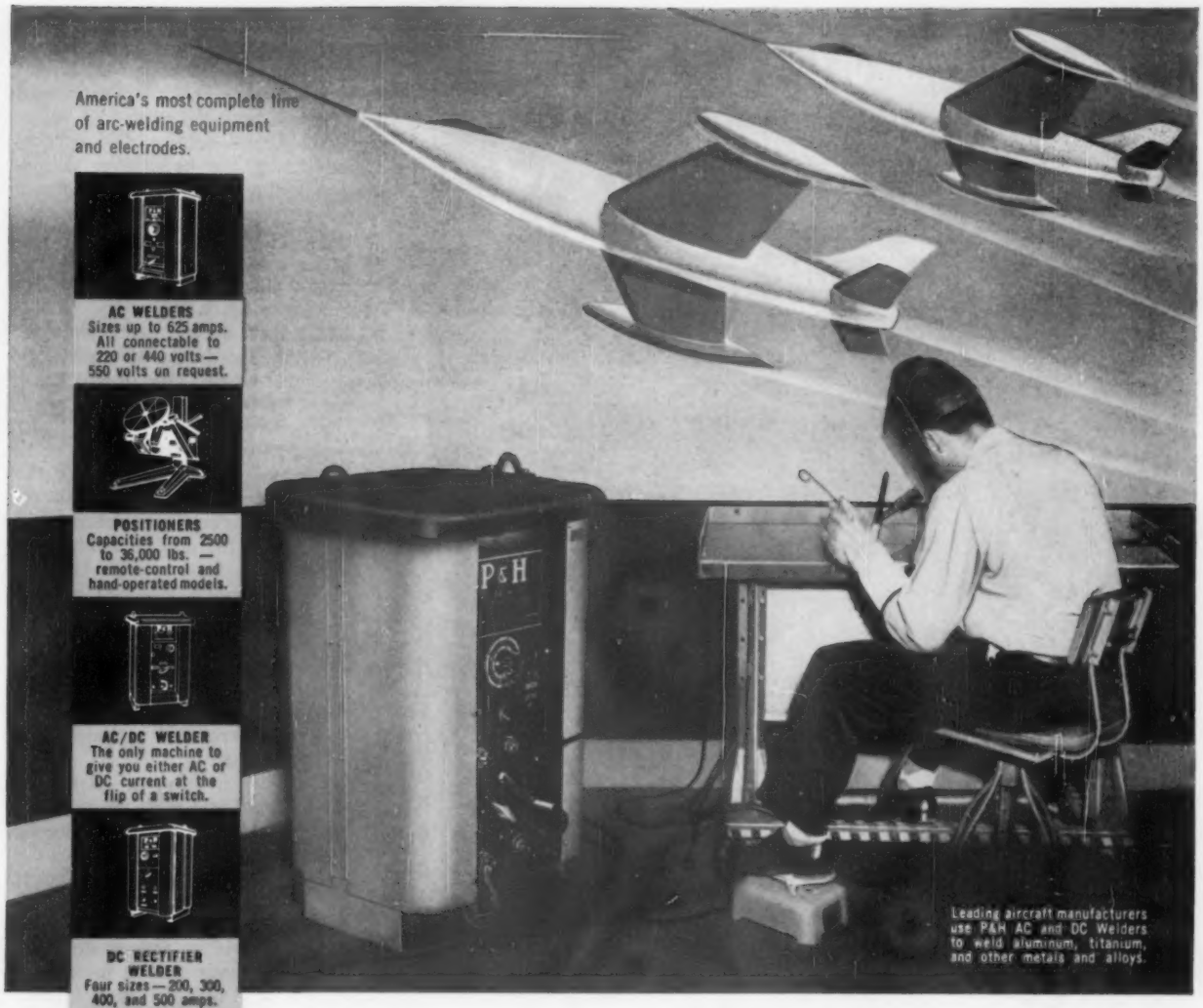
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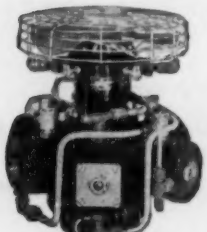

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PIONEERS IN THE DEVELOPMENT OF PNEUMATIC SYSTEMS FOR AIRCRAFT

age, Hasbrook implies that the Dove basically incorporates acceptable crashworthy design in the passenger cabin:

- Cabin's rugged structure, particularly aft of the front spar, protected passengers from fatal, crushing injuries.
- Collapse of the right wing without damaging the cabin structure adjacent to the wingroot also indicates desirable design precepts.
- Delethalized nature of seats and eabin components is indicated by lack of passenger injury.
- Lightweight ductile seats show absence of failure during the initial impact, indicating this type of seat can be designed to take high dynamic forces.

If the engines had stayed attached to the wings instead of breaking off in the first impact, it is possible that they might have imposed a pitching-up moment to the fuselage with subsequently less damage to the nose, possibly saving the crew from fatal injury. However, had they remained attached and the fuel tanks ruptured, there probably would have been fire.

The first row of passenger seats, unoccupied, broke free during the initial contact due to failure of the wall attachment brackets and partial collapse of the belly structure.

The Dove's flooring is a laminated plastic material and seats are rigidly attached to the belly structure. This rigid retention would encourage probability of seat attachment failure with damage to the belly and also directly transmit crash forces to the passengers spines. Making the floor an independent platform would alleviate these forces, Hasbrook says, and dampen crash forces.

Bell's Commercial Copter Sales Up 20%

Bell Aircraft Corp.'s commercial helicopter sales in 1954 climbed 20% above the 1953 record, while total billings for aircraft and spare parts increased 32%. Nearly 70% of the total business was with customers outside the U. S. and Canada.

Mainstay of the year's commercial sales was Model 47G, three-place aircraft with a 200-hp. Franklin Aircooled engine. The machines were delivered to 37 commercial and foreign military operators in the year. Of these, 26 took delivery on their first helicopters.

In the United States, Bell helicopters were sold to operators in Cleveland, Seattle, Dallas, Philadelphia, Denver, Fort Worth, Pittsburgh and New Orleans.

Bulk of Bell's sales in the year continued to go to U. S. military users. In addition to the HSL tandem for antisubmarine work, the company is developing the XV-3 convertiplane and the XH-13F turbine helicopter.

not one...

not two...

not three...but...

four...

Yes, *four* Lear-Romec pumps help the Sikorsky XH-39 set world's helicopter records for speed (156.005 mph) and altitude (24,500 ft).

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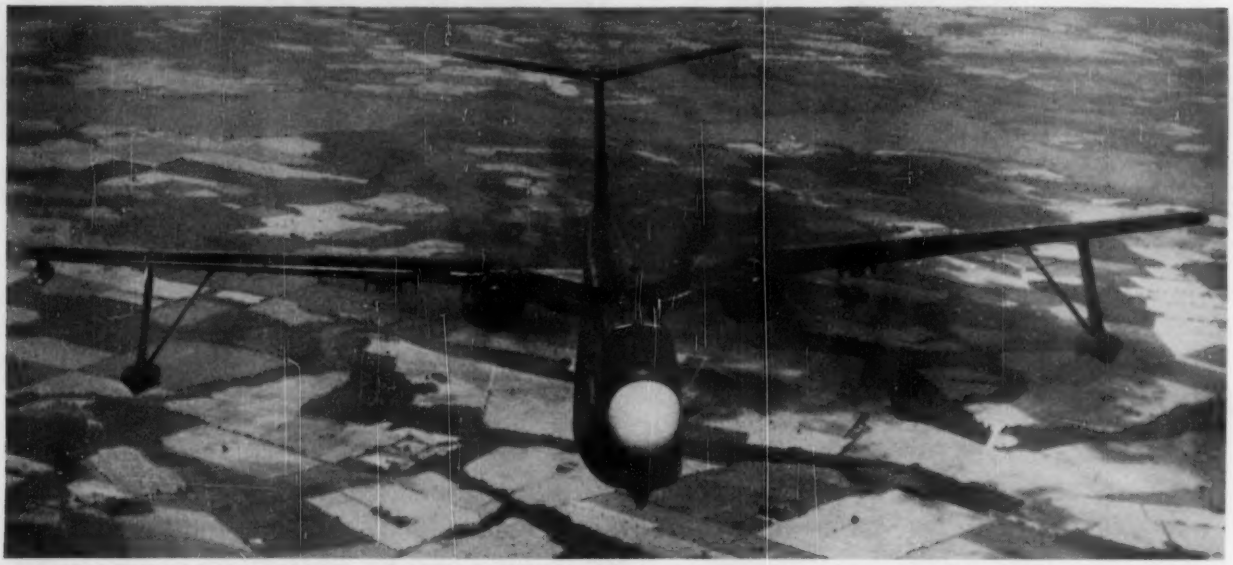
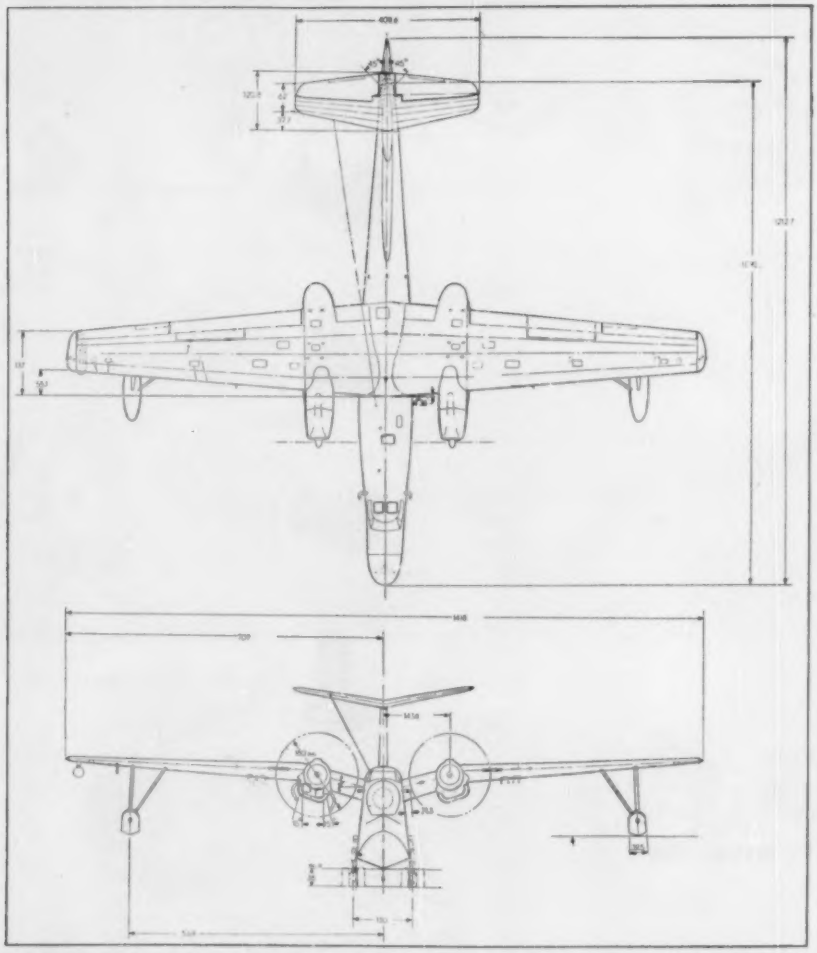
RO-13



P5M-2 MARLIN comes head on to show slim lines and high tail. Production seaplane, it is forerunner of Martin's jet-powered XP6M-1.

How Martin Tailored P5M to ASW Job



TWO-VIEW shows lines and dimensions of front and plan aspects of P5M-2 Marlin.

By Irving Stone

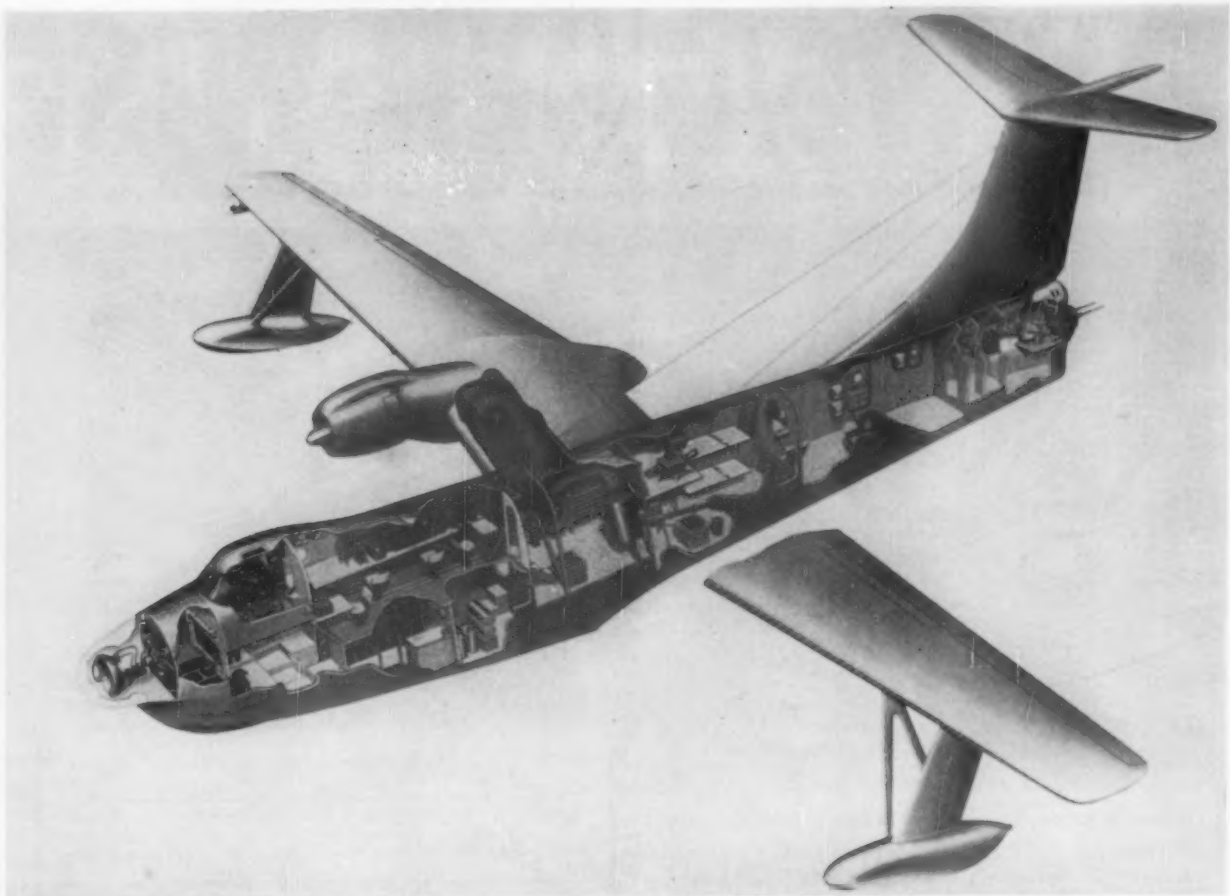
Glenn L. Martin's P5M Marlin patrol seaplane, an anti-submarine-warfare type whose long afterbody hull is particularly adapted for rough water operation, takes on increasing significance as the forerunner of the company's latest effort in water-based aircraft—the XP6M-1 SeaMaster. The SeaMaster is a jet-powered minelayer, just officially announced (AVIATION WEEK Jan. 10, p. 16).

For the new P6M family of aircraft, Martin engineers probably have drawn liberally from design and operational experience with the P5M aircraft, particularly with respect to water-handling characteristics. The P5M, thus, is important both as a design in its own right and as an indication of Martin's thinking for the future.

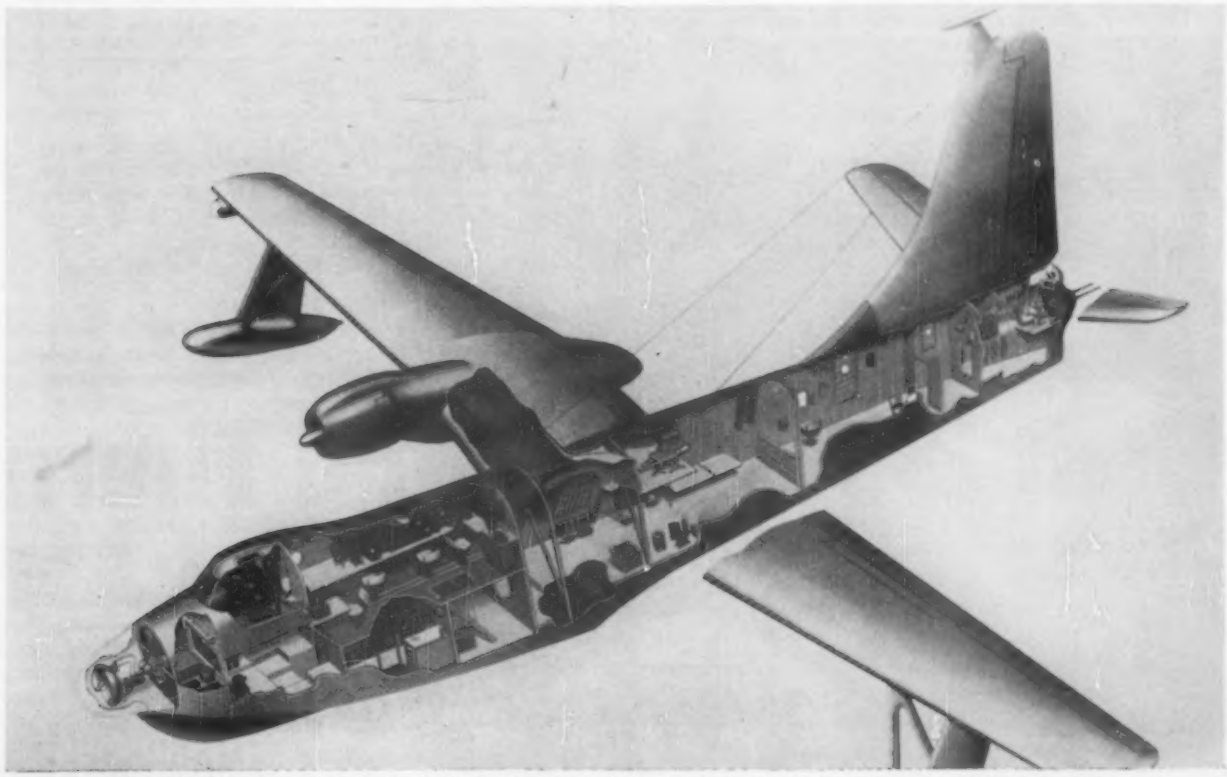
► **Production P5M-2**—First production P5M-2, latest of the series, was delivered to the Navy last June. Essentially the same as the P5M-1, the -2 version incorporates a number of design refinements. Among them:

• **T-tail.** Conventional tail of the P5M-1 was changed to a T-configuration in the -2 version. Aerodynamically more efficient, the T-tail requires less area, hence permits reduction in both structural weight and aerodynamic drag. The reduced drag means a considerable slash in fuel weight for a given range.

One version of the P5M-2 incorporating the conventional P5M-1 tail had a gross weight of 800 lb. more than the



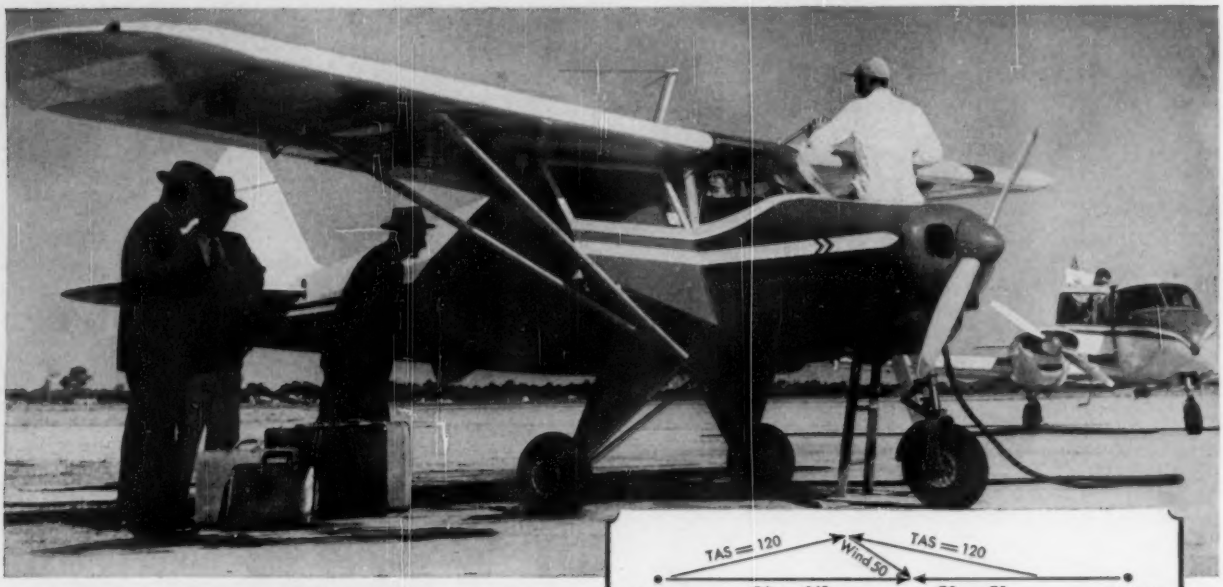
NEWEST P5M-2 MARLIN features slightly different compartmentation arrangement and new tail location compared with . . .



EARLIER P5M-1, which has conventional tail. Craft also has less fuel capacity because cells in hull center section are smaller.

FLY WEATHER-WISE

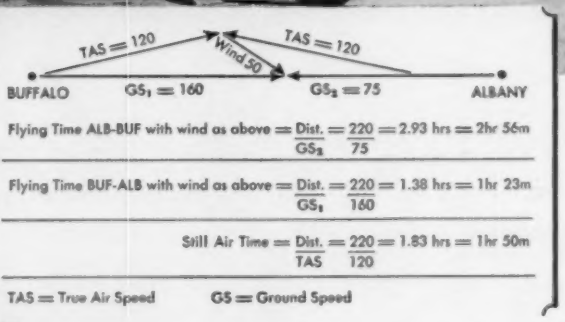
[These weather items prepared in consultation with the United States Weather Bureau]



It pays to keep a reserve supply of fuel in your tanks.

For instance: You lose more time flying from A to B against a headwind than you regain in the same wind returning from B to A. This is because the headwind acts on you longer than the tailwind does.

The example at right illustrates how you may lose 1hr-6m flying from Albany to Buffalo, but only pick up 27 minutes returning from Buffalo to Albany with the same wind.



Flying Time ALB-BUF with wind as above = Dist. / GS₂ = 220 / 75 = 2.93 hrs = 2hr 56m

Flying Time BUF-ALB with wind as above = Dist. / GS₁ = 220 / 160 = 1.38 hrs = 1hr 23m

Still Air Time = Dist. / TAS = 220 / 120 = 1.83 hrs = 1hr 50m

TAS = True Air Speed GS = Ground Speed

Flying across country on a clear, still night, the initial formation of *ground fog* may often be detected by the fuzzy, blurred appearance of lights in low spots where the air is nearing saturation. This may be followed shortly by dense ground fog lasting until after sunup in the morning. Don't get caught too far from an airport when you see these signs of fog.

Warning: Lights on *high* ground may not appear blurred, even though ground fog is forming at lower, damper spots and will soon spread to these higher elevations.

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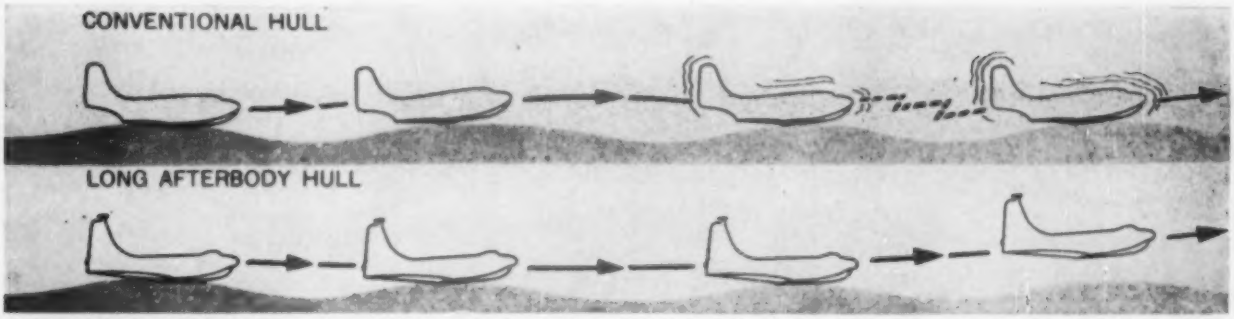
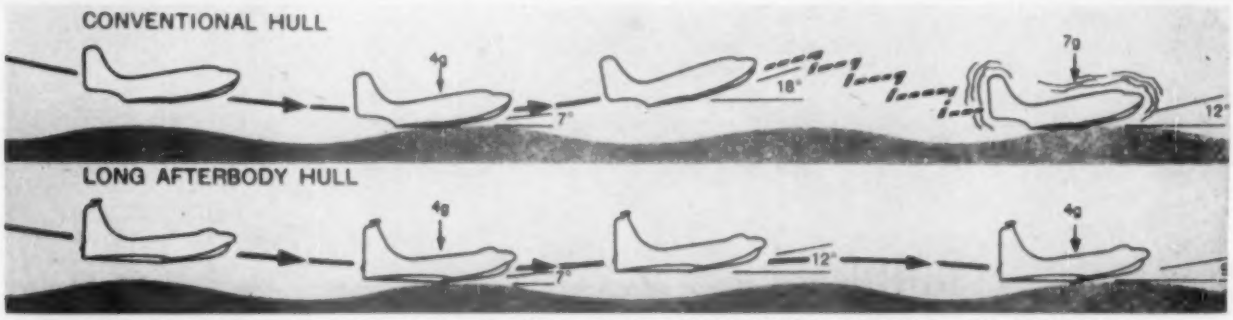


TAKEOFF COMPARISON shows action of short and long afterbody hulls. Both seaplanes are headed into wind, takeoff power applied.



LANDING COMPARISON shows both craft planing off with long afterbody design remaining trimmed at or below stall angle.

T-tail version, where both configurations had a range of 2,500 nautical miles. The weight boost stemmed from tail weight plus additional fuel, oil and tankage required.

• **Increased horizontal tail efficiency** results because of tail's higher position relative to wing downswash and prop slipstream.

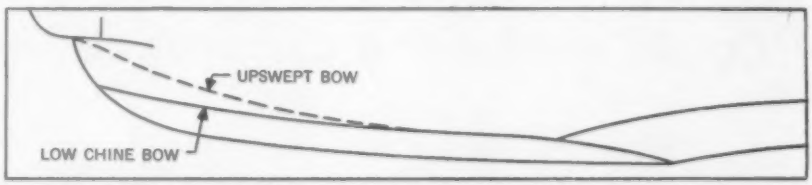
• **Increased vertical tail efficiency** stems from two sources—endplating effect of the horizontal tail, and lift distribution carryover on the hull below the tail, which is not present with a conventional horizontal tail located at the base of the vertical.

• **Problem of spray damage,** associated with a horizontal tail, is eliminated.

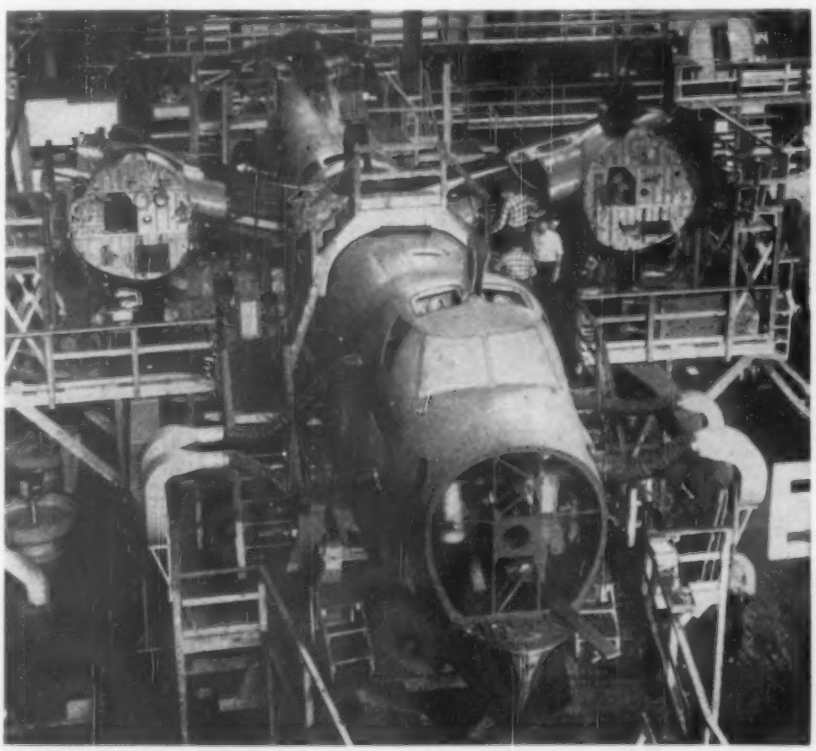
► **Hull Change**—The P5M-2 features a new bow with lowered chine line. Early studies conducted at Martin indicated that a lower bow chine would greatly reduce main spray height, and that satisfactory bow spray characteristics could still be maintained by proper fairing above the chine. Normal gross of the P5M-1 is about 73,000 lb. Full-scale tests of the low chine bow showed satisfactory spray characteristics at the maximum test weight of 80,000 lb., with prop tips still clear of the green-water blister.

Incorporated on the P5M-2, the change in bow design has resulted in a considerable reduction of spray height, stretched the life of the propellers, and permits takeoffs in heavier seas at higher gross weights than previously possible, Martin reveals.

► **Fuel Tankage Boost**—To increase the combat range available with the P5M-1,



LOW CHINE BOW on P5M-2 stretches prop life, cuts possibility of spray damage.



PRODUCTION LINE at Martin shows hull mated to center section of gull wing.

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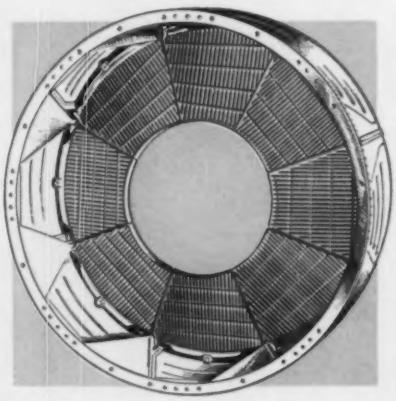

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Marlin History

Basic design of what is now the P5M-2 began with preliminary design studies started in July 1946, for the XP5M-1. First engineering drawing for this first plane was released in March 1947, and manufacturing commenced two months later. Basic engineering was completed in September 1947. First flight was on May 4, 1948, and flight demonstrations completed in January 1949. One month later the aircraft was delivered to the Navy.

Next plane in the series, P5M-1, had its mockup inspection in October 1949, and preliminary design studies were completed and first engineering drawings released the same month. Manufacturing was started in January 1950, and basic engineering was completed in August of that year. First flight of the P5M-1 was on June 22, 1951, and first model was delivered to the Navy in December 1951. The plane is now in service with both the Atlantic and Pacific fleets.

First production model of the P5M-2 was delivered to the Navy on June 23, 1954. The plane now is in mass production at the Glenn L. Martin Co.

hull tankage capacity in the -2 version was boosted by 820 gal. (from 1,205 gal. to 2,025 gal.) This provides a total airplane fuel capacity of 3,635 gal., compared to 2,815 gal. for the P5M-1.

This permits overload 2,500-mi. anti-sub missions to be flown with bomb bays free for armament stores.

The increased capacity is obtained by raising the deck level in the tank area and using larger fuel cells.

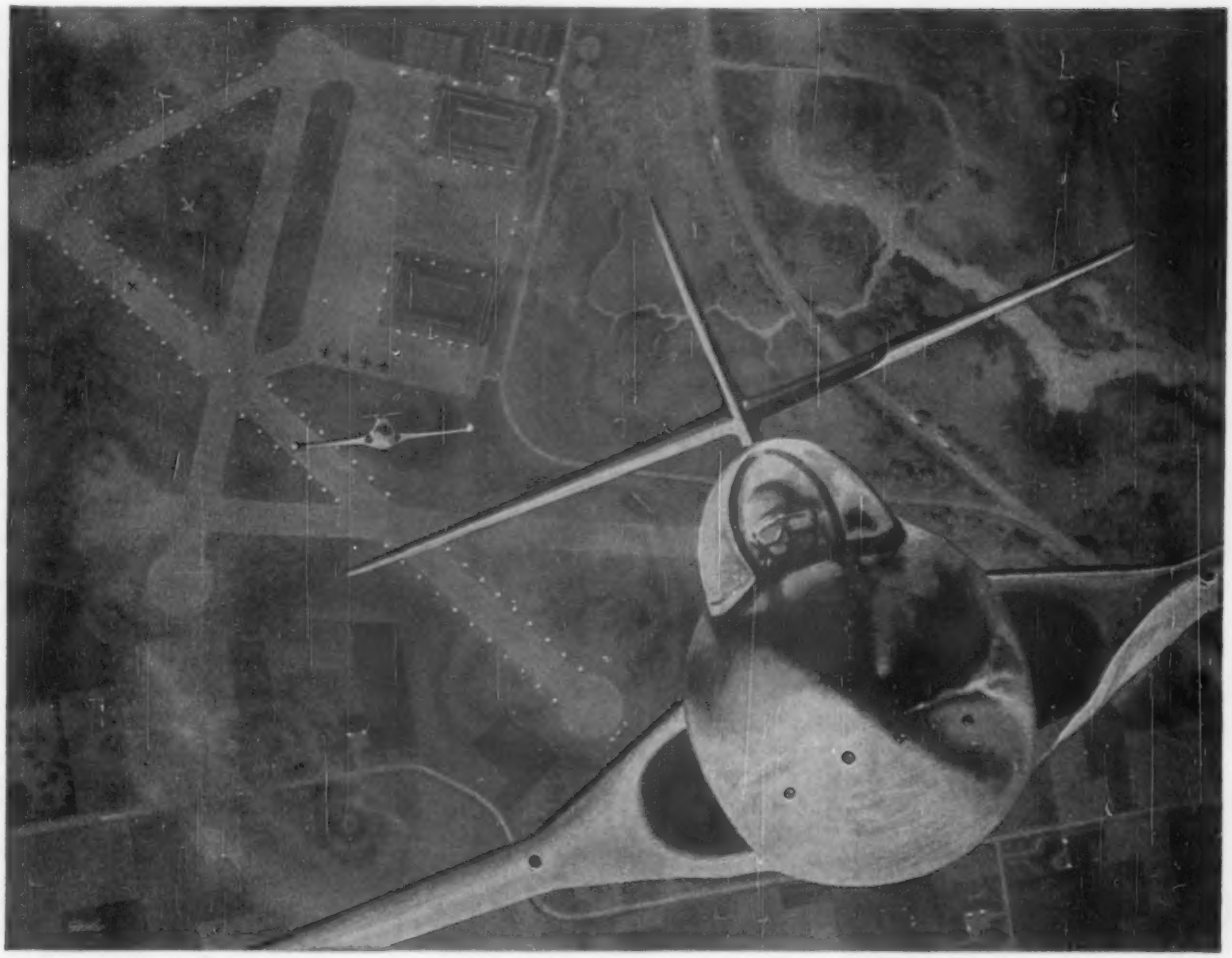
▶ **Other Refinements**—More powerful Wright Turbo Compound engines increase the performance of the P5M-2, to make it a more effective ASW weapon. Each of the plane's R3350-30W engines develops 3,450 hp. dry and 3,700 hp. wet.

The addition of good size side windows in the after-waist section of the -2 version gives adequate beam sighting facilities.

Other modifications consist of hull bulkhead changes for tail supporting structure and relocation or elimination of various hatches.

Structures and broad details of the P5M series are basically similar, hence the following specific details of the P5M-1 apply as well, generally, to the P5M-2:

▶ **Hull Makeup**—Hull is a semi-monocoque structure. Below the chine, hull bottom consists of plating reinforced by fore-and-aft stringers transversely spaced on about 6-in. centers. The stringers tie into deep floor frames longi-



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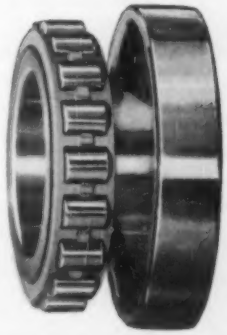

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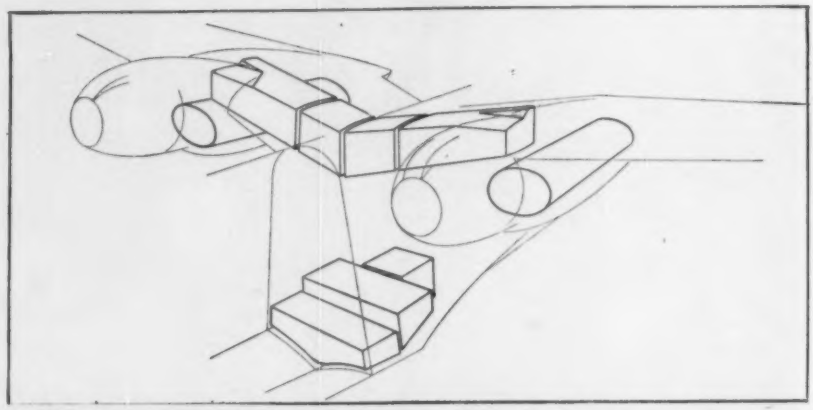

FUEL CELLS are located in wing, hull bottom. Droppable tanks are in bomb bays.

tudinally spaced about 20 in. apart. There is no structural keel such as incorporated in Martin's PBM Mariner series, forerunner of the P5Ms.

The area above the chine is made up of crown and side skin and an upper longeron supported by frames at an average spacing of about 7 in. There are five watertight bulkheads, four of them in the forebody.

Truss type bulkheads are located at the wing's front and rear spar locations for the wing connections.

The hull configuration resulted from a hydrodynamic research program in which Martin, Navy, National Advisory Committee for Aeronautics, and Stevens Institute of Technology cooperated. The aim was to obtain a hull shape that afforded superior open-sea rough-water characteristics. Result was the long afterbody lines of the craft.

Another refinement was the elimination of the large transverse step in the hull bottom and the inclusion of a V-type step to reduce drag.

Martin reports that the seaplane's long afterbody hull affords inherent hydrodynamic attitude control, maintained within a narrow range of trim angles even during the settling-down period following contact with the water.

The long hull reduces greatly the normal bouncing or planing-off tendencies, and if the craft planes off, the hull design prevents an uncontrollable atti-

P5M-2 Marlin Design Data

• Principal Dimensions	
Length overall, ft.	98.9
Height overall, ft.	33.0
Height overall, on beaching gear, ft.	31.6
Span, ft.	118
• Wing	
Area, total, including ailerons, flaps and 103.32 sq. ft. of hull, sq. ft.	1,406.33
Flap area, total, aft of leading edge, sq. ft.	204.30
Conventional aileron area, total, aft of hinge line, sq. ft.	60.80
Tab area, total (included in aileron area), sq. ft.	5.13
Spoiler aileron area, total, sq. ft.	46.49
• Horizontal Tail	
Area, total (chord plane), sq. ft.	262
Stabilizer area, total, to elevator hinge, including 32.4 sq. ft. of contained elevator balance, sq. ft.	173
Elevator area, total, aft of hinge line, sq. ft.	89
Tab area, total (included in elevator area), sq. ft.	7
• Vertical Tail	
Area, total (including 26 sq. ft. of dorsal), sq. ft.	226
Fin area, to rudder hinge, including 17.7 sq. ft. of contained rudder balance, sq. ft.	177
Rudder area, aft of hinge line, sq. ft.	49
Tab area (included in rudder area) sq. ft.	6.5
• Airfoils	
Wing	
Root	NACA 23020
Tip	NACA 4412
Horizontal Tail	
Root	NACA 65_1-012.8 Mod.
Tip	NACA 65_1-010 Mod.
Vertical tail	NACA 63A-012 Mod.
• Powerplant	
Engines	Two Wright R-3350-32W
Takeoff power, dry, bhp.	3,450
Propellers	Ham. Std. 4 blades
• Weights	
Empty, lb.	46,933
Normal ASW gross, lb.	73,055
Maximum overload design gross, lb.	85,000

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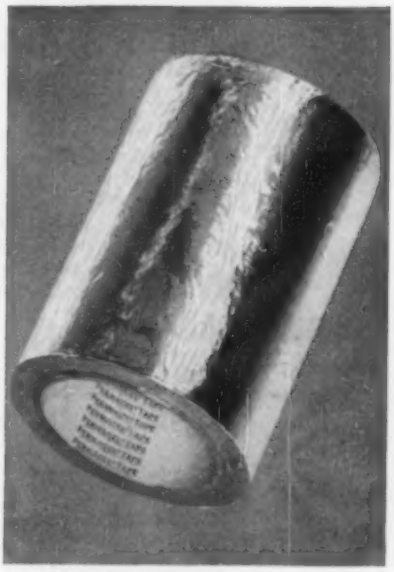

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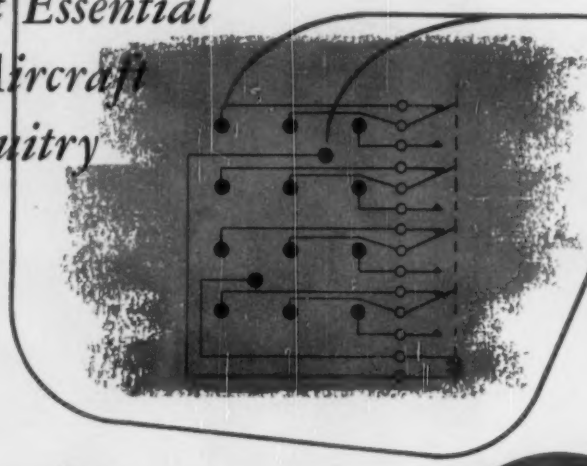

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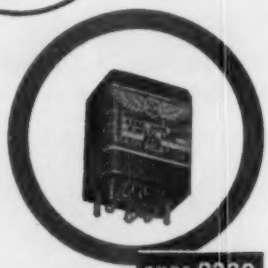
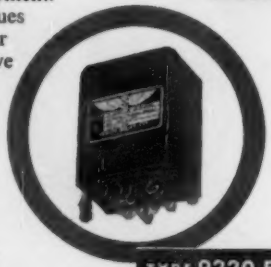


TYPE 9220



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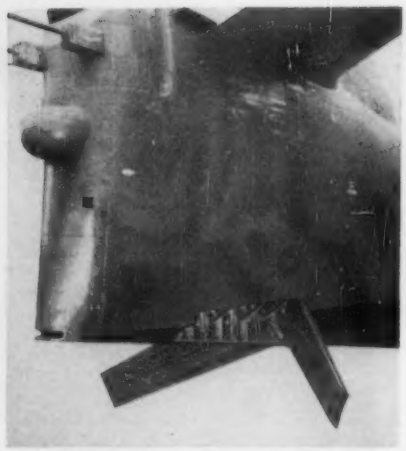


HYDROFLAPS on hull bottom afford high water maneuverability for P5M.

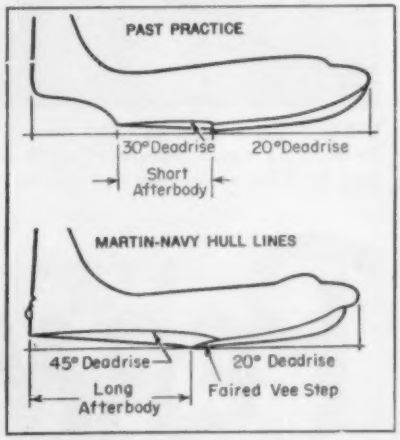
tude, for example, nosed up above the stall angle, Martin reports.

Instead of uncontrollable stalling while moving below critical flying speed, the craft remains at such a trim angle that the large-chord elevators give the pilot complete pitch control, it is said. Thus, the Marlin is not subjected to violent, secondary impacts during landings, and reduction in structural loads is obtained. Also, the low trim angles give the additional advantage of improved seaway view.

Adequate lateral control is another consideration for rough water operation. Spoiler ailerons, in conjunction with conventional ailerons, counteract any strong rolling tendencies which may develop during takeoff and landing.

► **Hydroflaps**—The Martin-developed hydroflaps on the P5M serve as the counterparts of a landplane's steerable nose wheel and brakes. The installation consists of two hydraulically actuated hinged flaps located in the after-hull bottom. Extension or retraction is by toe action on the rudder pedals.

Extended individually, the flap segments act as a water rudder. Extended



SHORT VS. LONG afterbody designs show respective features in side views.

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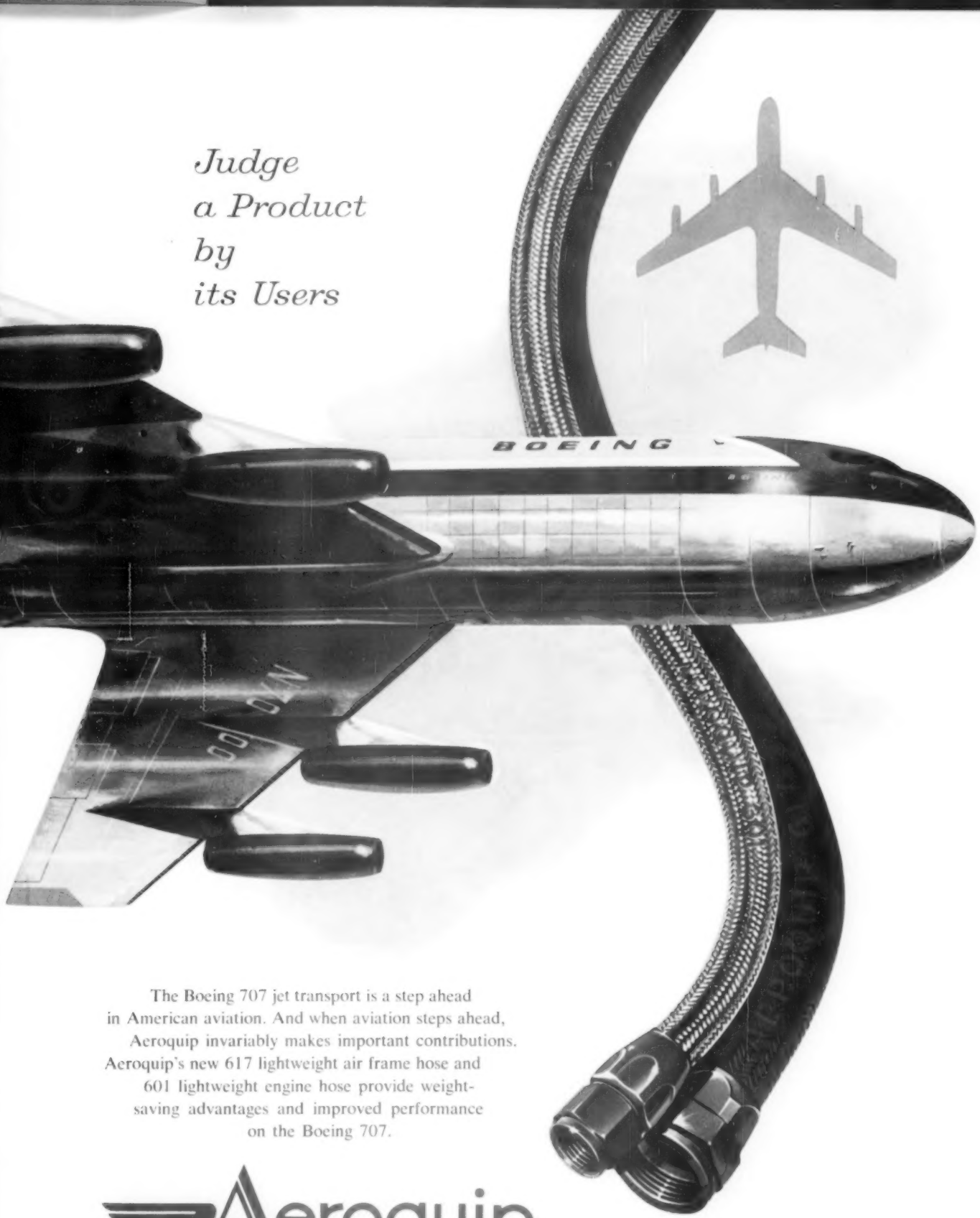

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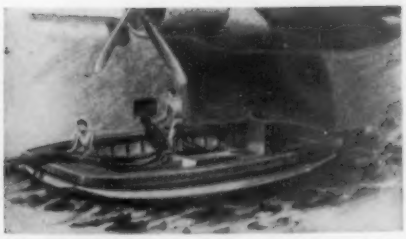

REFUELING P5M from ship or shore can be accomplished at fast rate.

together, they serve as water brakes or sea anchors. A load-limiting device allows the hydroflaps to retract enough to prevent damage if they open an excessive amount at high water-speeds. Accidental operation in air, up to full simultaneous deflection, produces a negligible trim change, Martin says.

Also, crosswind taxiing can be accomplished with symmetrical power, thus easing an engine cooling problem.

▶ **Wing**—This is a high-gull cantilever type, embodying a center section integral with the hull, two removable outer panels and tips. Center section forming the gull has a 16-deg. dihedral. Outer wing has a 3-deg. dihedral.

The wing involves box beam makeup. Cover panel assemblies consist of single skin and corrugation with chordwise formers, except in the center wing between front and center spars, where double skin is used because of the rubber fuel and oil cells installed in this location.

Vertical shear strength is afforded basically by three spars running the entire span of the wing.

Eight ribs at 50 to 150-in. spacing provide bulkhead strength in the wing box, and are located at points where large concentrated loads are introduced into the wing structure. Leading edge of the wing is removable.

▶ **Surfaces**—Elevators, rudder and conventional ailerons are single-spar structures with metal torque box leading edges and fabric-covered rib construction aft of the spars.

Spoiler ailerons consist of single skin and spanwise corrugation construction, with chordwise formers.

Wing flaps are of two-cell box, metal-covered construction with a single spar and ribs at about 7½-in. spacing.

▶ **Float, Strut**—Tip float is a monocoque structure with three watertight compartments. Makeup is of frames and skin, with no stringers in the bottom. Two main bulkheads for the main and side strut attachments serve as watertight walls, with additional watertight bulkheads provided at the bow and stern.

Float bracing consists of a main strut and two side struts, pin-connected to the float and wing. Main strut has two spars separated by reinforced structural covers, with fairings for streamlining. Side struts are extruded I-shapes with

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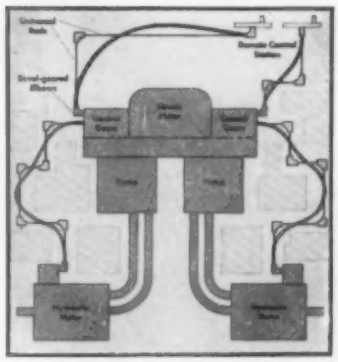

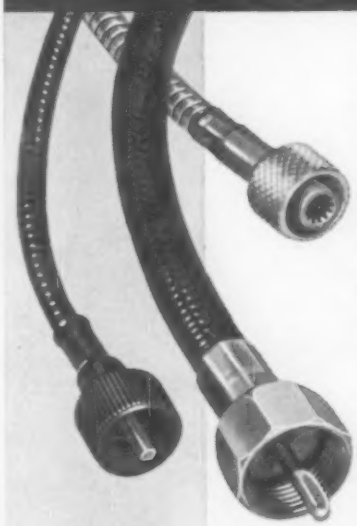

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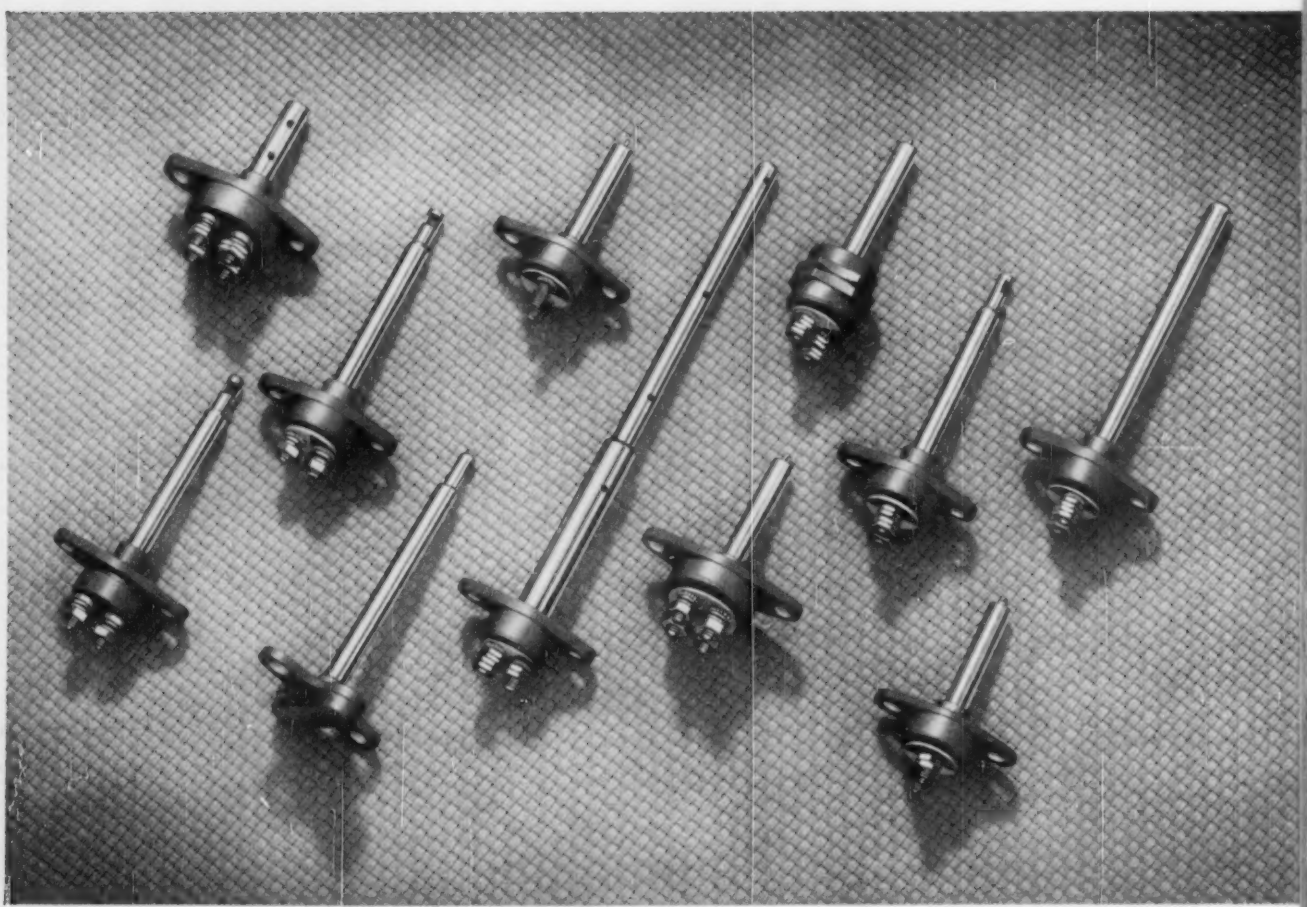
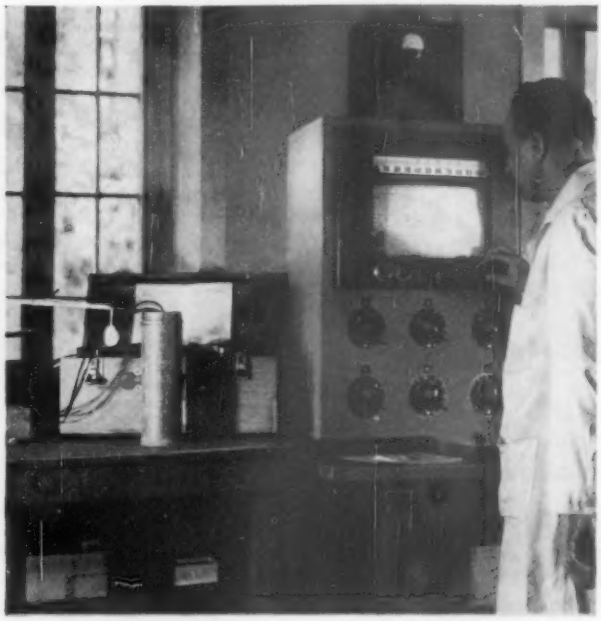
announces a complete line of

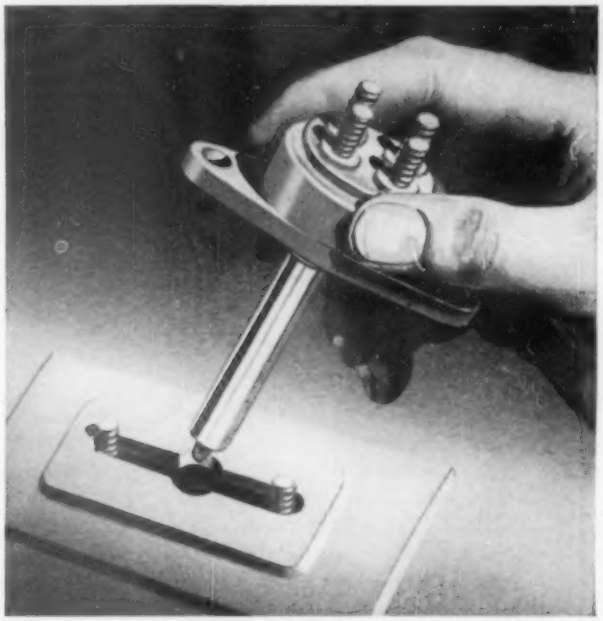
Aircraft Gas Turbine Thermocouples



1. SAFETY IN THE AIR GETS ANOTHER "LIFT" FROM FENWAL. Long famed for its precisely accurate Aircraft Fire and Over-Heat Detectors, Fenwal now brings the aircraft industry a complete line of Aircraft Gas Turbine Thermocouples. This line has been developed in cooperation with leading manufacturers of jet engines. So essential to turbo-jet operation, these Thermocouples reflect topflight Fenwal engineering in every detail of design. Fenwal's current production (over 30 different Aircraft Gas Turbine Thermocouples) serves the needs of nearly every type of American jet engine. Both single and dual junction models in stagnation type and exposed junctions are available.



2. HIGHEST ACCURACY. Here a Fenwal technician checks a Thermocouple for calibrated accuracy. This is typical of Fenwal's strict quality control during manufacture. Thorough testing and inspection assure dependable performance. Fenwal engineers work directly with military and civilian aircraft technicians to perfect methods of application.



3. WHERE JET PROTECTION BEGINS. Fenwal Thermocouples — the "finger on the pulse" of jet engines — are located in the combustion chamber and tail pipe, protecting vital parts from critical high temperatures. In these vital areas, where the slightest temperature variation can be a matter of life and death, Fenwal Thermocouples are on guard.

4. NO LIMITS! Fenwal Thermocouples, along with Fenwal Fire and Over-Heat Controls, are used in practically every type of jet-propelled aircraft, from the smallest to the mightiest. These Thermocouples are engineered to stand up under the critical temperatures, speeds and ceiling requirements of modern turbojet aircraft. And the unique construction enables them to withstand extreme vibrations — still another Fenwal contribution to safety and efficiency.

5. GET THE FACTS. Read the complete details about Fenwal Gas Turbine Thermocouples in this new illustrated booklet. Endorsed by leading aircraft engine manufacturers, and by government authorities, Fenwal is a major source of these and other essential instruments for temperature control and detection in every type of aircraft. Write for your copy to **Fenwal Inc., Aviation Products Division, 121 Pleasant Street, Ashland, Massachusetts.**

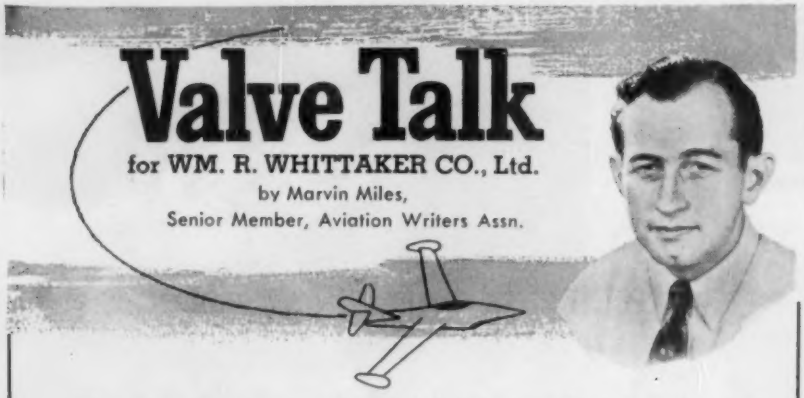
Fenwal

AIRCRAFT GAS TURBINE
THERMOCOUPLES

Valve Talk

for WM. R. WHITTAKER CO., Ltd.

by Marvin Miles,
Senior Member, Aviation Writers Assn.



Flying the Arctic is a cinch, at least the way Scandinavian Airlines System does it.

Just like flying over Texas at night, or Kansas or Idaho, but with no bumps, even in daylight.

You take off at Los Angeles International a few moments after midnight, drone up the airways to Winnipeg for the first refueling about breakfast time. You've just about time for a stroll in the snow and the ear-tingling air before you're off for Sondre Stromfjord, Greenland — or "Bluie West Eight" as it was coded during World War II.

In no time, it seems, you run out of daylight, for you're flying against the sun, but you get an awesome panorama of northern Canada's vast snow barrens and a glimpse of Hudson Bay before night closes in on the Douglas DC-6B Royal Viking.

At Bluie West the captain obligingly pipes the GCA landing instructions into the cabin and you become acquainted with the "talk down" procedure even if you're flying VFR. Every landing at Greenland is GCA, for both the radar men and the flight crews like practice against the time when the white mists close the little strip that's hemmed by rock walls.

There's a brief chance to stretch your legs again in the neat little prefabricated hotel S-A-S has erected at the USAF base where service personnel are elated to have a direct air link with home—and Europe as well. Travelers either way have heretofore been a novelty.

Once more you crunch through ice and crusted snow and climb into the warmth of the cabin for a downwind takeoff, back over the chill, dark fjord, for the towering rocks force every landing in a single direction and every takeoff 180 degrees in reverse.

Across Greenland the Viking bores her way, climbing above the Arctic circle and out over the frigid Greenland Sea where from the darkness of your bunk you can see enormous chunks of ice floating in the black depths 17,000 feet beneath you. And above, the northern lights eerie in the star-flecked sky.

Beyond the tip of Iceland you again cut across the Arctic circle to slant southward on the Great Circle course, cruising above the Norwegian Sea, across the tip of Norway over the blue Skagerrak and the Kattegat and into Denmark's wonderful capital, Copenhagen.

Twenty-four hours out of Los Angeles – with no change of plane – and you're in Europe, within a quick hop of any Continental capital.

If the flight is long, it's smooth and delightful, with out-of-this-world service in both the cuisine and wine departments. S-A-S, like other foreign airlines, has a knack for making passengers so at ease the hours tick by without notice.

Take the average luncheon, for instance. First your choice of drinks, as many as you like, with almonds on the side. Then soup and salad, with assorted wines. Next the entree, rich and delicious, with more wines. Followed by dessert, perhaps an ice cream cake mounted on an ice base with colored lights glowing from within. Then cognac, liqueurs? Followed by coffee and more liqueurs and finally your choice of chocolates from an enormous array. And will you have more champagne, sir?

By the time you finish luncheon, it's practically time for dinner . . . to the point where there's almost too much food so beautifully served it's practically irresistible; too much wine to tempt the "unwary."

A far cry from the old Vikings in their tiny, serpent-prowed vessels.

In a tour throughout Europe with S-A-S I can truthfully say you'll forget about the weather – if it ever worried you. I have never felt so much at ease in taking off into zero ceilings, in flying through cotton so thick it obscured the ailerons; nor experienced so many consistently "painted on" landings.

Weather is something that leaves your mind as soon as you enter the cabin to settle down to your book – if you can ward off the food and the champagne!

If all foreign airlines accord passengers the all-around service given by S-A-S, then I'll venture that our airlines could pick up many a tip from European ways and means.

To the Arctic-pioneering Scandinavian carrier — congratulations!

(Advertisement)

sheet metal fairings attached.

► **Nacelle**–Portion of the nacelle behind the engine houses the bomb bay. It is composed of frames, bulkheads, formers and a lower-longeron to which clamshell doors are hinged.

Door assemblies are interchangeable for both inboard and outboard installations on both nacelles.

For protection of stores incorporating avionic devices, each bomb bay is insulated and warmed by an internal combustion heater so that inside temperature on a −40F day is maintained at a minimum of +40F. In summer the bomb bays can be ventilated so that the inside temperature on a 100F hot day does not reach a point in excess of 140F.

► **Fuel Tankage**–Three tanks are installed below the hull deck directly beneath the wing. These are flexible, self-sealing Mareng cells. Two wing service tanks of similar self-sealing construction are located in the wing center section above the hull tanks. These tanks normally are used for direct fuel supply to the engine.

Mounted outboard of the service tanks are two auxiliary tanks, one in each wing panel. These units are non-self-sealing Mareng cells.

In the P5M-1 there are two droppable bomb bay tanks, one per bay, constructed of aluminum alloy.

Provisions are made to purge the interior of the auxiliary wing tanks, and the cavities surrounding the hull tanks, with carbon dioxide for combat protection.

Fuel from any tank can be used for either engine, either through the normal service tanks or directly to the engine. When fuel is being used from the wing service tanks, it is replenished automatically from a pre-selected auxiliary tank.

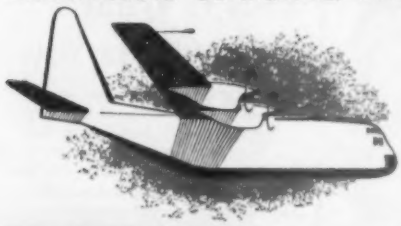
► **Fuel Jettisoning**–The jettison system is designed primarily to take fuel from the auxiliary wing tanks at a total rate of 50 gpm.

Plane's fuel is jettisoned through a tube extending overboard at the hull stern post. Jettisoning the contents of the auxiliary tanks should lighten the plane sufficiently for emergency single-engine operation, but fuel from the hull and bomb bay tanks (if dropping is not desired) also can be jettisoned by using the transfer pumps.

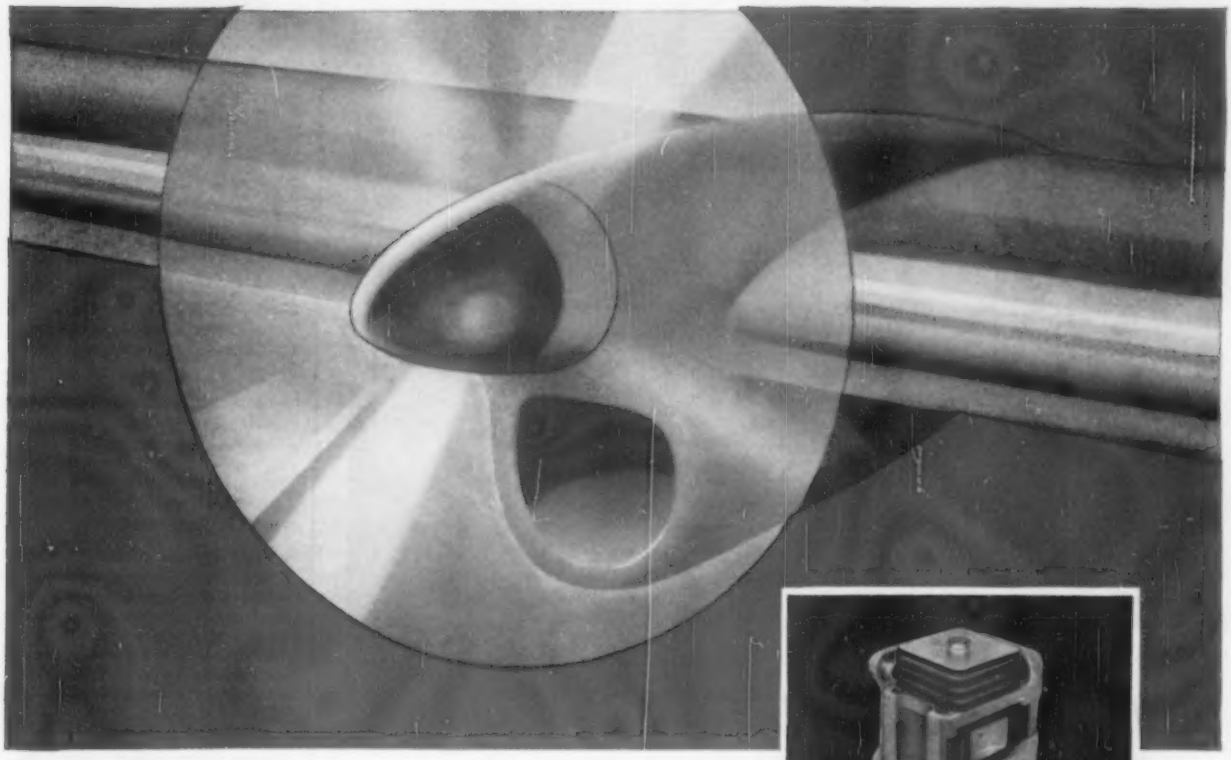
Jettison line is continuously air-purged in flight except when fuel is being jettisoned. Then a check valve prevents fuel discharge through the air inlet.

► **Icing Protection**–Wing and tail leading edges are protected against icing by pneumatic rubber boots (Goodrich Type 20, a 15-psi. rapid-action unit). Boots are cemented to the surface to prevent lifting during air loads. Electronic timing control provides for se-

ANOTHER SPECIAL VIBRATION PROBLEM SOLVED BY LORD



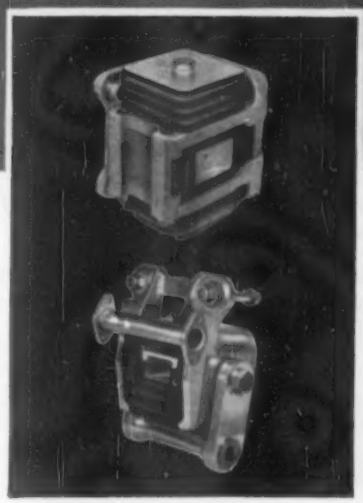
the case of the "hot turbo-prop"



Turbo-props "pack a lot of power" in providing the R3Y-1 and C-130 with their outstanding performance. But these same power plants presented two major problems affecting efficient operation. The first was to isolate heavy propeller disturbance, and the second to control engine vibration under extremely hot conditions—with temperatures (at the mounting points) as high as 475°.

LORD engineering and research produced the best answers to these problems with LORD LM-200 MOUNTS on the C-130 and LORD J-5216-SA MOUNTS on the R3Y-1. These mountings are only two of the many successful solutions that LORD has produced for vibration control in the aircraft field. On light planes and heavy transports, on "hot" high-speed planes and hovering helicopters—LORD products have materially reduced vibration and improved performance.

LORD's 30-year record of accomplishment in vibration control, coupled with exceptional engineering, research, and production are the down-to-earth reasons why LORD is equipped to provide the best solutions to problems involving aircraft vibration control.



The outstanding LM-200 turbo-prop aircraft engine mountings, designed and built for long, high-efficiency performance under extremely hot operating conditions.

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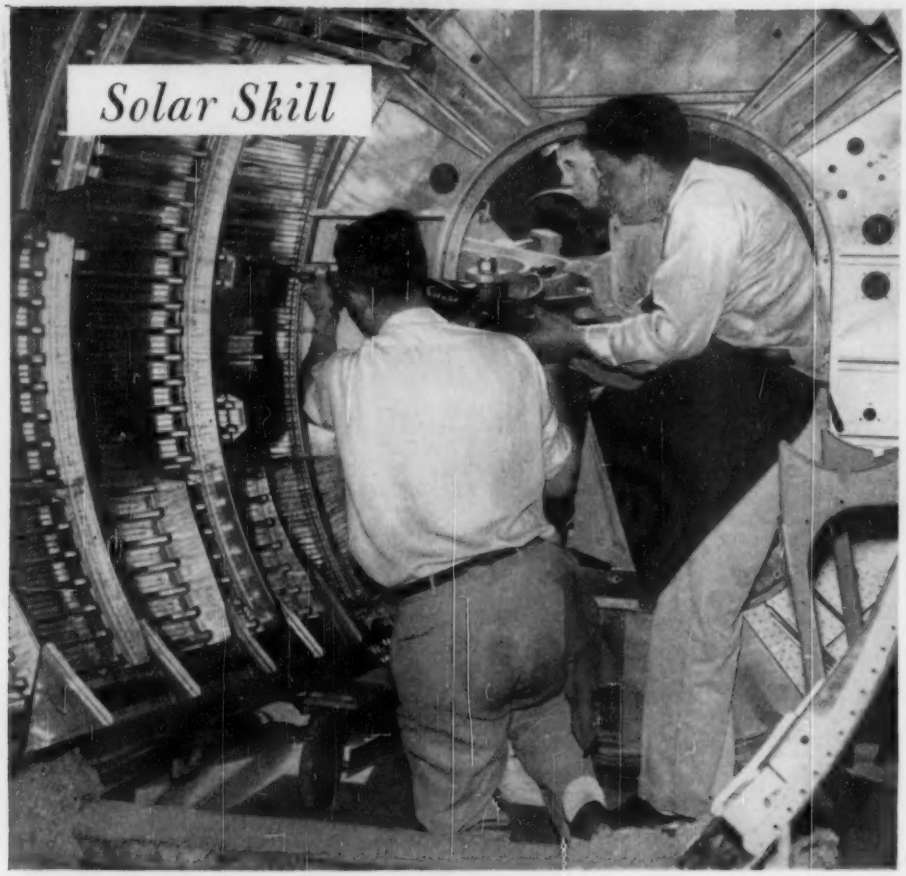


This unique nacelle is made possible by Solar's skill with stainless alloys

WHEN NAVY PATROL PLANES hit the runways, the impact calls for rugged construction. So in the famed Neptune series, Lockheed's designers made a radical departure starting with the P2V-5. They called for engine nacelles of stainless steel, to provide greater structural strength with less installed weight than conventional aluminum nacelles. Weighing only 370 pounds, each nacelle must support a Wright turbo-compound powerplant weighing over 5000 pounds.

Solar was selected to take on the challenging job of producing these nacelles. It involves precise forming and welding of half- to full-hard stainless steels in fabricating the intricate skin and rib structure. With more than 550 detail parts, the nacelle assemblies required development of many special tools and processes.

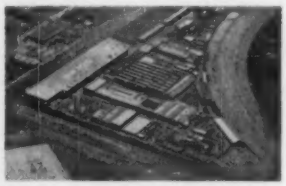
Volume manufacture of stainless steel nacelles and other airframe structures typifies Solar's skills with high strength alloys—skills based on 27 years of research, engineering, and fabricating experience with these metals. This backlog of knowledge is available to every company faced with difficult applications of stainless and titanium alloys. How can Solar help *you?*

SOLAR AIRCRAFT COMPANY — SAN DIEGO, DES MOINES

DESIGNERS, DEVELOPERS AND MANUFACTURERS OF METAL ALLOY PRODUCTS

This is What Solar Offers You

Solar specializes in the manufacture of precision products from alloys and special metals for severe service. Solar's experience since 1927 is unduplicated in this field. Solar skills and facilities range from research, design and development through to mass production. Wherever heat, corrosion or difficult specifications are problems, Solar can help you solve them.



PLANTS. *In San Diego (photo above) and Des Moines. A total of 1,400,000 sq ft of floor space. Approximately 5,000 employees. Annual sales over $65,000,000.*

EQUIPMENT. *Production equipment for all types of metal fabrication—forming, machining, welding, brazing, casting, coating. Extensive laboratory and testing equipment. Facilities for development, prototype, limited or mass production.*

SERVICES. *Research, design, development, tooling and production engineering staffs. Experienced with all alloy steels, stainless alloys, super alloys, and titanium and its alloys. Government source inspection and Solar quality control meet rigid aircraft and commercial standards.*

CONTRACT PRODUCTION

Current orders include aircraft engine and airframe parts, alloy castings, pneumatic ducting, atomic energy components. Customers include some of the most honored names among aircraft and industrial companies in the U.S. and Europe.

SPECIAL PRODUCTS

Bellows. *"Sola-Flex"® bellows and expansion joints in many designs from ½ in. up to the world's largest, 28 ft in diameter.*

Gas Turbines. *Solar "Mars" 50 hp engines for auxiliary generator sets, ground carts, portable fire pumps; Solar "Jupiter" 500 hp engines in variable and constant speed models.*

Ceramic Coatings. *"Solaramic"® is the Solar trade mark for a family of coatings that protects metals from heat, corrosion, galling and abrasion.*

Controls. *Complete control systems utilizing the new Solar "Microjet"® principle for control of gas turbines, jet engines and pneumatic devices.*

FURTHER INFORMATION
Your inquiry regarding any Solar product or service will receive prompt attention. Address
Solar Aircraft Company
Department A-63
San Diego 12, California

lective operation. Boots are removable for warm weather operation.

External protection against ice on the windshield is by an alcohol spray, and against rain and bow spray by the usual windshield wipers. Internal defogging and defrosting is by heated air.

► **Camera Installation**—A camera is used for damage assessment in both day and night operations. Mounted in a streamlined pod, the camera is stowed in the after-hull. For camera use, the pod is attached to the outside of the inboard-opening starboard waist hatch after the plane is airborne.

The mount is designed for pod indexing so that camera attitudes can be made from vertical to 45 deg. aft. For night photography, a flash tube unit mounted in a similar pod on the port waist hatch provides illumination for good photographs up to altitudes of 300 ft.

The overall arrangement permits camera and flasher to be kept clean and free of salt water spray, pods can be serviced and installed from inside the craft at any time, and both units can be left at the base with resultant weight saving for missions where camera will not be required.

Control system is wired to start camera operation from the bomb circuit impulse. With the master switch on and the day-night switch and timers at proper selection, the camera and flasher operation is automatic, providing proper delay and photos of each store drop.

► **Maintenance, Servicing**—Almost all routine engine maintenance adjustments can be made from a nacelle compartment through a removable firewall door. Complete access is by quickly removable cowling, in conjunction with specially designed engine work platforms and hoist attaching to upper wing surface.

Oil coolers are readily accessible and removable through doors on the upper wing surface.

Single station pressure fueling permits complete refueling from ship or shore in a few minutes. Gravity feed fueling provisions also are included for both wing and hull tanks.

Bomb bays and underwing armament store stations are loadable from top of wing.

Towing provisions are incorporated for refueling from tenders. A bow towing pendant is provided and a bridle fitting for steadying lines is located on each wing leading edge outboard of nacelles. A stern towing fitting is used for holding off, and also serves as an attachment for a restraining line during engine warm-up.

Two built-in hoist fittings are located on the hull-top centerline at the wing for hoisting the craft aboard a tender or dock at a specified gross weight.

...with vision

Bell Aircraft is offering unlimited opportunities to structures engineers with creative ability. Bell's new approach to the fields of vertical takeoff, reconnaissance and fighter aircraft requires engineers with imagination.

We are looking for the same type of engineers who 10 years ago launched Bell on its pioneering program into supersonic and high altitude flight with such famous aircraft as the X-1, the X-2 and the 1650 m.p.h. X-1A.

Today Bell offers structures engineers challenging assignments involving the so-called *"thermal barrier"* in supersonic and hypersonic flight. By helping to insure the success of tomorrow's revolutionary aircraft, you will have the opportunity to demonstrate your ability to the fullest. Excellent positions are now available for the following:

2 Project Structures Engineers 6 Structures Design Engineers
3 Structures Research Engineers 12 Stress Analysts
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At Bell, you receive top pay and liberal benefits including Life Insurance, Hospitalization, Surgery, Paid Holidays, Sick Leave, Vacations and Educational assistance.

Our Chief of Structures will review your qualifications. To arrange a personal interview send your resumé to: Manager, Engineering Personnel

BELL *Aircraft* CORPORATION

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"GET 'EM ON THE RISE!"

TO ENGINEERS who are skilled in aerodynamics...or structural design...or flutter and dynamics... or electronics...or physics...or missiles control...or weapons systems, BEECHCRAFT may offer an opportunity that is quite superior to the average job opening.

BEECHCRAFT has long been known as the leader in the production of civilian and executive type aircraft. This market is now growing rapidly as the top businessmen all over the world begin to appreciate the increased financial returns made possible by company airplanes.

This corporation and executive market is a stabilizing influence on BEECHCRAFT's volume of production, which actually consists of a major portion of military work and a lesser portion of commercial work.

BEECHCRAFT is aggressively entering new fields and needs skilled engineers to do creative work of top-level quality in these fields. If you would like to be associated with a leading organization that is large enough to have diversification of product, but small enough to insure recognition of personal ability shown by those who have it, and if you do possess superior skills in the categories first mentioned, write to –

Beechcraft

Beech Aircraft Corporation, Wichita, Kansas, U. S. A.

PRODUCTION BRIEFING

▶ **Lycoming Division**, Avco Manufacturing Corp., Stratford, Conn., has built its first production R1300-3 piston engine, following acquisition of production equipment from Willys, Dowagiac, Mich., which had been producing the powerplant. The 900-hp. Lycoming R1300, built under Curtiss-Wright license, incorporates 75 engineering changes made by the Stratford firm. Engine powers the Sikorsky H-19B, North American T-28A and is installed experimentally in Piasecki copters.

▶ **Lunn Laminates, Inc.**, Huntington Station, N. Y., has acquired Ueber Tool & Manufacturing Co., Detroit tool and die maker, which it will operate as a subsidiary.

▶ **Kaman Aircraft Corp.**, Bloomfield, Conn., has announced a company-paid pension plan for salaried and hourly paid employes. Plan is retroactive to December 1945, when Kaman was incorporated. Basic plan provides retirement benefits of $21 a year for each year of service (maximum 30 years). Supplementary plan provides benefit of 7% of basic annual earnings in excess of $4,200 a year for each year of credited service. These benefits are in addition to Social Security. Program is to be handled by Connecticut General Life Insurance Co.

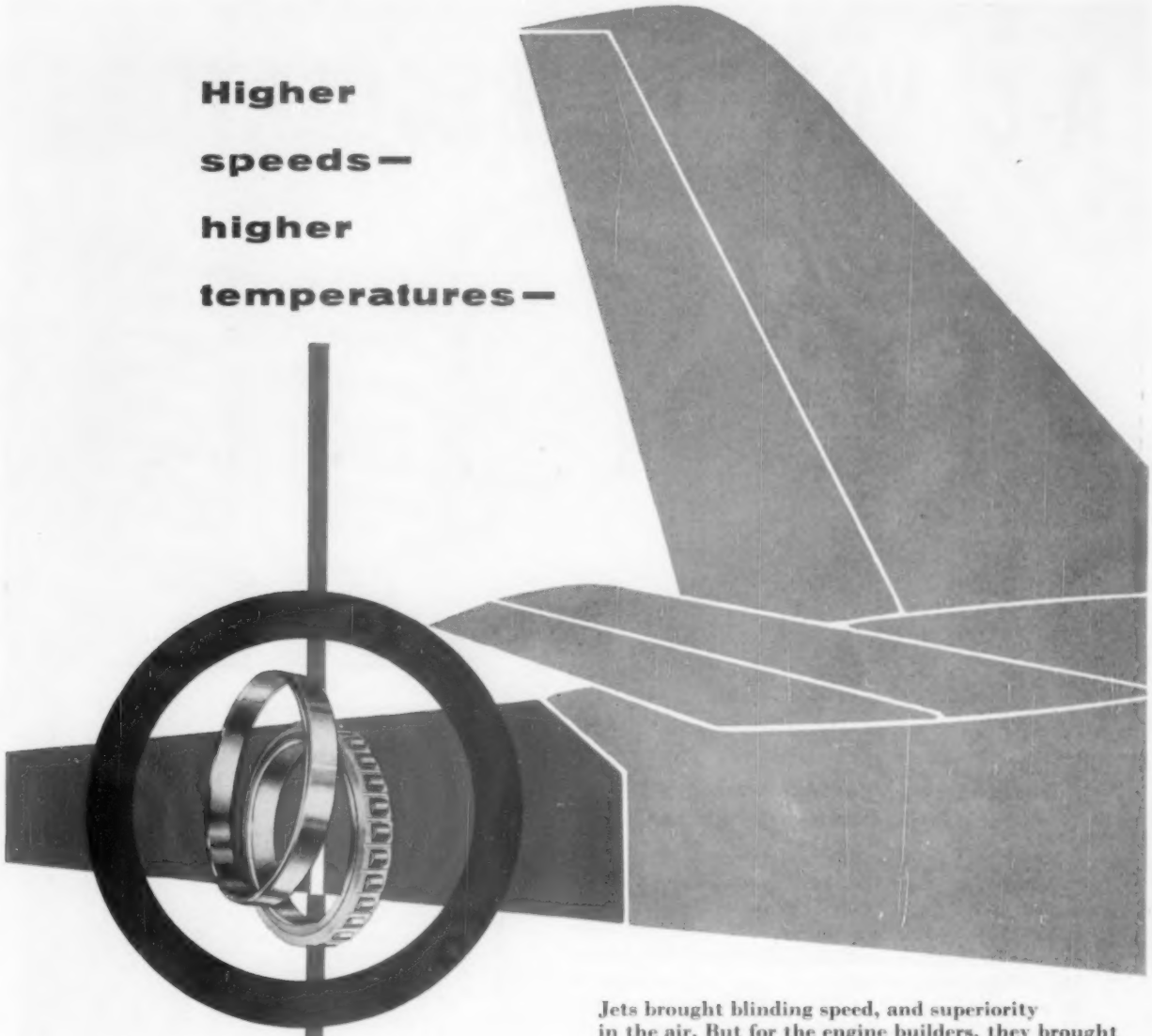
▶ **L. S. Starrett Co.**, Athol, Mass., precision tool maker, celebrates its 75th anniversary this year.

▶ **Custom and standard** high-temperature alloys, in sample or production quantities, to suit customer's needs, are offered by Cannon-Muskegon Corp., 2875 Lincoln St., Muskegon, Mich.

▶ **Bellanca Aircraft Corp.**, New Castle, Del., will become affiliated with L. Albert & Son, Akron, Ohio, if stockholders approve. Agreement involves an exchange of Bellanca stock for certain Albert assets, designed to build up the aircraft firm's resources and increase its diversification.

▶ **Saving of $14,000 annually** on boring and reaming is obtained by Boeing-Seattle through use of a company-designed "step" drill which performs both tasks in one operation. New tool is similar to ordinary metal drills except that halfway through its length the diameter changes. Pilot portion of the drill cuts an undersize hole, final portion enlarges it to the proper diameter. New drill is said to save 8,000 drilling operations on each B-52 jet bomber wing.

Higher speeds— higher temperatures—



HYATT BEARINGS!

Jets brought blinding speed, and superiority in the air. But for the engine builders, they brought problems. With higher speeds came higher operating temperatures, and engine parts, especially bearings, had to be designed to withstand destructive heat. So designers turned to Hyatt. With unexcelled research and development facilities, modern production equipment, and years of experience, Hyatt was a logical choice. Hyatt know-how assured highest quality in mass production, and since 1944 Hyatt has been a major supplier of jet bearings. When design requirements are beyond the capabilities of ordinary bearings, always call on Hyatt.

Partial list of aircraft equipped with turbo-prop and turbo-jet engines using Hyatt Bearings:

Bell X-5 Research Monoplane
Boeing XB-47C Air Force Medium Bomber
Consolidated—Vultee Model 7002 (XF-92A)
Consolidated—Vultee Turboliner
Douglas XA2D-1 "Skyshark" Navy Attack Bomber
Grumman F9F "Panther" Navy Fighter Plane
Lockheed F-80C "Shooting Star" Fighter Plane
Lockheed F-94A & B Air Force Fighter Plane
Lockheed TO-1 U.S. Navy Version of the F-80G For Use as Jet Trainer
Martin P4M-1 Long Range Navy Patrol Bomber
Martin B-57A U.S. Air Force Version of the English Electric Canberra Medium Bomber
North American AJ-1 "Savage" Navy Carrier Attack and Search Airplane
Northrop F-89A All Weather Fighter Plane
Northrop YRB-49A "Flying Wing" Heavy Bomber
Republic F84F "Thunderjet" Fighter Plane

HYATT

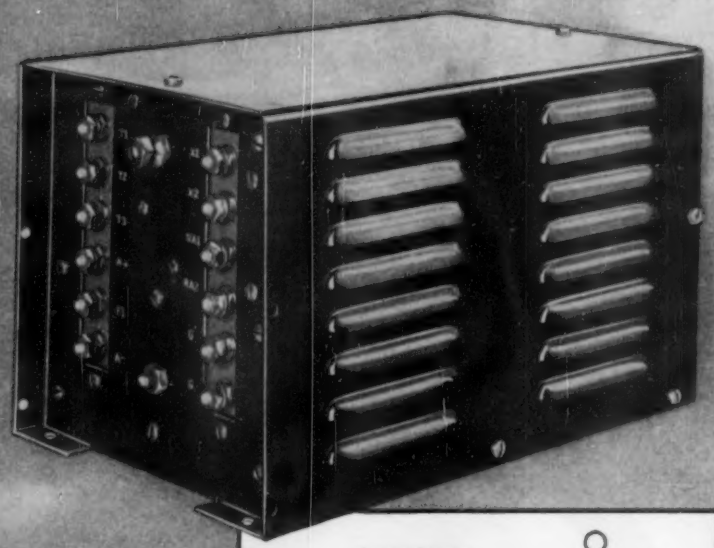
STRAIGHT ROLLER BARREL ROLLER TAPER ROLLER

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, N. J.

A-C VOLTAGE REGULATORS

NO VACUUM TUBES

NO MOVING PARTS



Designed as "perfect partners" for Jack & Heintz a-c generators

Contributing to the increased acceptance of J&H "packaged" a-c generating systems for aircraft is a new series of voltage regulators. These units are designed to operate with J&H a-c generators rated from 10 through 120 kva, including: blast-cooled (120°C ambient), thermal lag, and environment-free oil- or vapor-cooled machines. Incorporating reactive load division circuits, the new regulators can be used in either isolated or parallel systems.

Static-Magnetic Design

These regulators feature a completely static design consisting primarily of magnetic circuits offering these important advantages over comparable carbon-pile and electronic-type regulators:

1. Eliminate need for vacuum tubes—means increased reliability, longer service life.

2. No moving parts—maintenance reduced to a minimum.

Jack & Heintz engineering personnel and manufacturing facilities are geared to undertake design and production of complete a-c systems or individual components. We invite your inquiry. Write Jack & Heintz, Inc., 17635 Broadway, Cleveland 1, Ohio. Export Department: 13 East 40th Street, New York 16, N. Y.

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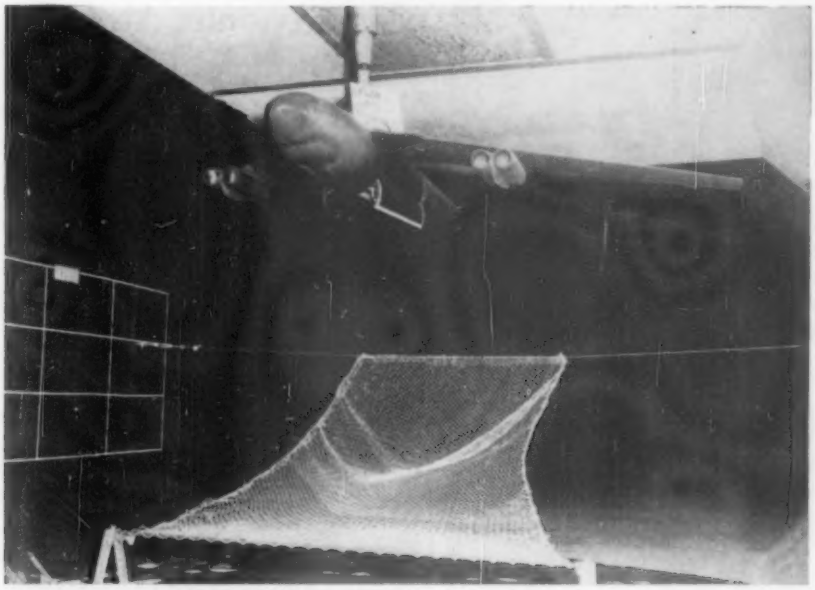
GENERAL DESIGN DATA*

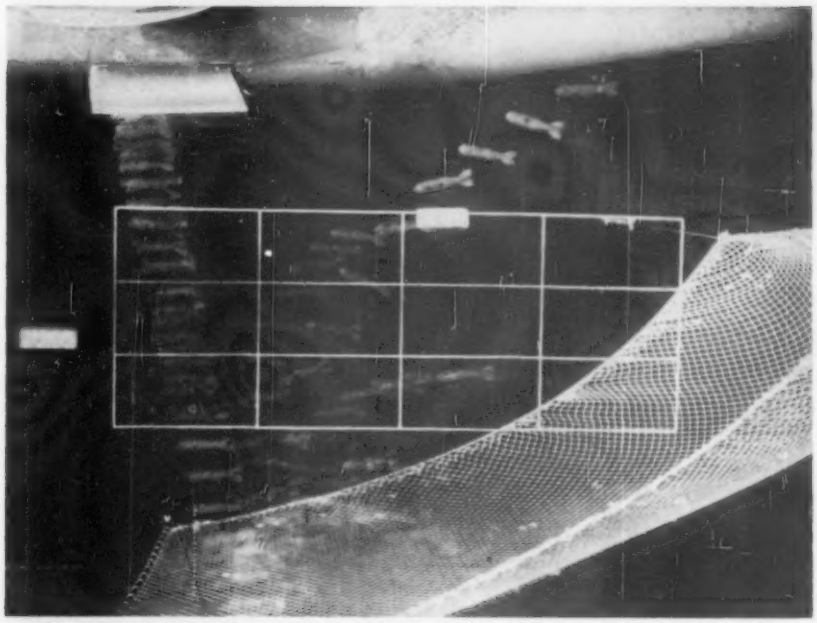
- 115/200 volt, three phase or 115 volt, single phase.
- Frequency ranges of 380/420, 320/480 and 320/1000 cps. Others to suit.
- Regulate generators with power factors from .75 to 1.0.
- Hold voltage to within 2½ volts of rated, under normal operating conditions.
- Hold voltage to within 5 volts of rated, under all operating conditions.
- Return voltage to normal value within 0.18 seconds following removal of system faults or load changes.
- Operate satisfactorily over temperature ranges as wide as −55°C to +120°C.
- Envelope size and weight generally less than required by specifications.
- Mount in any position.

**All J&H a-c regulators are designed to meet the requirements of MIL-G-6099 and USAF Drawing 53D6793.*

Military specification numbers as used herein are for purposes of product identification only and do not necessarily imply specification conformity.

JACK & HEINTZ *Rotomotive* **AIRCRAFT EQUIPMENT**





BOMB DROP of cluster from B-47 Stratojet is studied by Boeing photographic technique. Images to right of vertical drop line are bombs which have rebounded from net. Grid locates bombs during fall, and markings on bombs show rotation and other ballistic factors.

Multi-Exposures for Drop Studies

Dynamic studies of droppable stores—fuel tanks, missiles and bombs—can be made inexpensively with a simple modification to a standard camera, Boeing Airplane Co. reports.

Faced with the problem of taking multiple-exposure pictures of drops from the bomb bay of a B-47 model, a Boeing photographer and three engineers came up with a simple solution.

They made and mounted a slotted disk ahead of a standard four-by-five Speed Graphic; for a cost of about $500, they designed, built and tested the "pinwheel" and had the unit operational in about four weeks.

► **Test Technique**—Tests were made in the University of Washington subsonic windtunnel with a model of the B-47 Stratojet mounted above an inclined net to catch the missiles. Behind the model, against the far wall of the tunnel, a grid was painted for orientation of the bombs during drop.

Results of the drop tests are typified by the photo above, showing the cluster drop of bombs from the B-47. All data is presented on a single piece of film, instead of on a multiple strip hundreds of feet long.

Fastest exposure with the current unit is 1/3,000 sec. Boeing engineers have an improved "pinwheel" in the design stage for operation at speeds as high as 1/50,000 sec.

Navy Contracts

Contracts recently announced by the Navy's Aviation Supply Office, 700 Robbins Ave., Philadelphia 11, are:

Atlas Paint and Varnish Co., 50 Buffington Ave., Irvington 11, N. J., synthetic, gloss enamel, 20,000 gal., $37,000.

B. F. Goodrich Co., 500 S. Main St., Akron 18, Ohio, boots, de-icer, $93,638.

Douglas Aircraft Co., Inc., 827 Lapham St., El Segundo, Calif., publications for automatic pilots, $83,195.

Flight Refueling, Inc., Friendship International Airport, Baltimore 3, maintenance parts for AJ-2 aircraft, $124,554.

Jack and Heints, Inc., 17600 Broadway, Cleveland 1, Ohio, starters, $482,885.

Kearfott Co., Inc., 1150 McBride Ave., Little Falls, N. J. maintenance parts used on GE instruments, $374,085.

McDonnell Aircraft Corp., P.O. Box 516, St. Louis 3, parts for F2H, $53,045.

New York Air Brake Co., Watertown Div., Watertown, N. J., hydraulic pump assys., 62 ea., $47,010.

Pacific Div., Bendix Aviation Corp., 11600 Sherman Way, N. Hollywood, Calif., bladders used on accumulators, 2,684 ea., $43,031; cylinders, valves and actuators, $265,379.

Parker Aircraft Co., 5827 W. Century Blvd., Los Angeles 45, separator valves, fittings, cap and manifold assys., $29,062.

Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn., services for Hamilton Standard propeller blades, 162 ea., $30,231.

William Armstrong Smith Co., 109 E. Forest Ave., East Point, Ga., exterior paint, traffic, $51,000.

Aircraft Hardware Mfg. Co., Inc., 810 Edgewater Road, Bronx 59, N. Y., parachute links, 57,100 ea., $29,407.

AiResearch Mfg. Co., 9851-9951 Sepulveda Blvd., Los Angeles 45, actuators, 88 ea., $42,205; services and material to overhaul and repair refrigerator units, turbine assys. and heat exchangers, $100,000; services and material required to overhaul and repair AiResearch Mfg. Co. gas turbine power unit, and parts, $268,000.

Atlas Paint & Varnish Co., 32-50 Buffington Ave., Irvington 11, N. J., enamel, synthetic, gloss, air drying, white, 15,552 gal., $29,393.

Douglas Aircraft Co., Inc., 827 Lapham St., El Segundo, Calif., maintenance parts for AD aircraft, $288,901.

Eagle-Picher Co., American Bldg., Cincinnati 1, pigment, 216,000 lb., $30,996.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., valve assys., de-icers, for use on JRB, 88 ea., $25,177.

G. Felsenthal & Sons Inc., 3500 N. Kedzie Ave., Chicago 18, computers, 8,084 ea., $34,034.

Goodyear Tire & Rubber Co., Inc., 1144 E. Market St., Akron 16, maintenance parts for wheel and brake assys., $30,245.

Greer Hydraulics, Inc., New York International Airport, Jamaica 30, N. Y., propeller units, 14 ea., $95,262.

H. Boker & Co., Inc., 101 Duane St., New York, parachute harness rings and adapters, $60,831.

New Jersey Zinc Sales Co., Inc., 160 Front St., New York 38, pigment, 252,000 lb., $33,667.

Radio City Products Co., Inc., Centre & Glendale Sts., Easton, Pa., main channel tuning assys., 655 ea., $78,731.

Roflan Co., Corner Route 1 and Camp Meeting Road, Topsfield, Mass., cord assys., 8,151 ea., $32,686.

Sargent Engr. Corp., 2533 E. 56th St., Huntington Park, Calif., hydraulic cylinders, $34,648.

The newest EDISON fire detection system now provides positive protection for another of America's great aircraft—CONVAIR's B-36 long-range intercontinental bomber.

Prompt fire detection is assured even if the sensing cable breaks, for each half will function as a closed circuit. And the entire EDISON system operates directly from the aircraft power supply without the need of electronic tubes.

Years of actual experience and constant research in the world-famous EDISON Laboratory provide this aircraft fire detection system to keep pace with the advancements of modern flight.

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New Avionic, Aircraft Facilities Writeoffs

Office of Defense Mobilization has granted Hughes Aircraft Co. a certificate of necessity for a military electronics facility amounting to $352,651 with 65% allowed for accelerated tax amortization. Other certificates granted during the Dec. 2-15 period:

Holley Carburetor Co., Van Dyke, Mich., military aircraft turbine controls, $88,621 certified with 80% allowed.

Minneapolis-Honeywell Regulator Co., Minneapolis, scientific instruments, $180,950 certified with 65% allowed.

M. C. Manufacturing Co., Lake Orion, Mich., aircraft parts, $134,478 certified with 70% allowed.

Lockheed Aircraft Corp., Burbank, Calif., military aircraft, $185,989 certified with 65% allowed.

Northrop Aircraft, Inc., Hawthorne, Calif., military aircraft, $80,000 certified with 60% allowed.

OVERSEAS SPOTLIGHT

Air Charter to Buy DC-4s

LONDON

Air Charter, Ltd., big British independent air transport firm, plans to spend $900,000 to buy three used Douglas DC-4s, because "there is nothing to buy in Britain," says its managing director. The first Skymaster is to be delivered this month.

The company expects the DC-4s to last for an interim period of three or four years, after which it expects other planes, such as the Britannia, to be available.

Air Charter denies reports that it was forced to buy the American planes because the British War Office would not permit use of the company's fleet of Tudor transports for carriage of troops.

$44 Million for Airports

TORONTO

Canada's Department of Transport plans to spend a total of $44 million on improvements of Toronto's Malton Airport and Montreal's Dorval Airport. These expenditures are part of a $75-million airport program for all Canada.

Improvements scheduled for Malton and Dorval:

• **Malton.** New terminal and tower, including large public waiting rooms, expanded ticket and service offices, enlarged customs and immigration offices. Terminal will be at south end of field, with loading ramp extending from terminal building so several planes can load at same time.

• **Dorval.** New terminal building, including a nursery, playroom, theatre and cocktail bar; helicopter landing field; two new runways, 8,000 and 10,000 ft. long; system of surveillance radar. Area of airport will be increased to 4,000 acres from present 1,577 acres.

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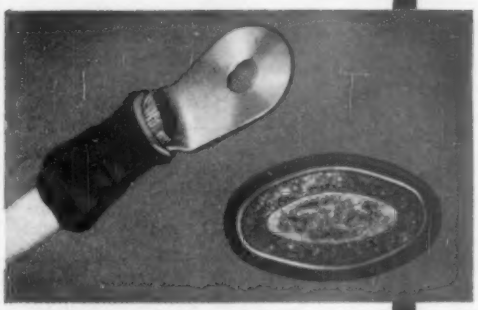

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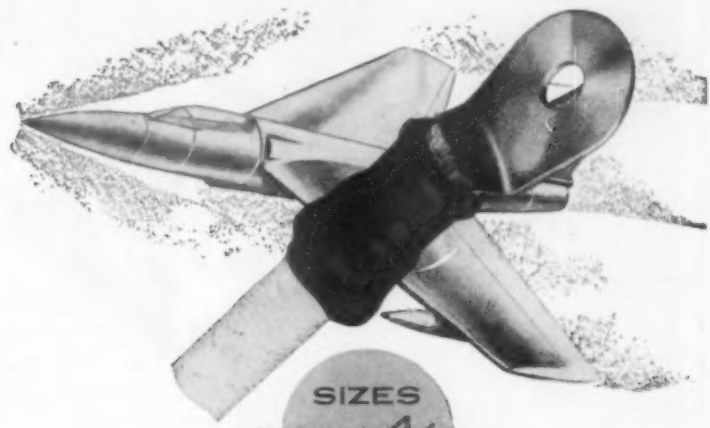

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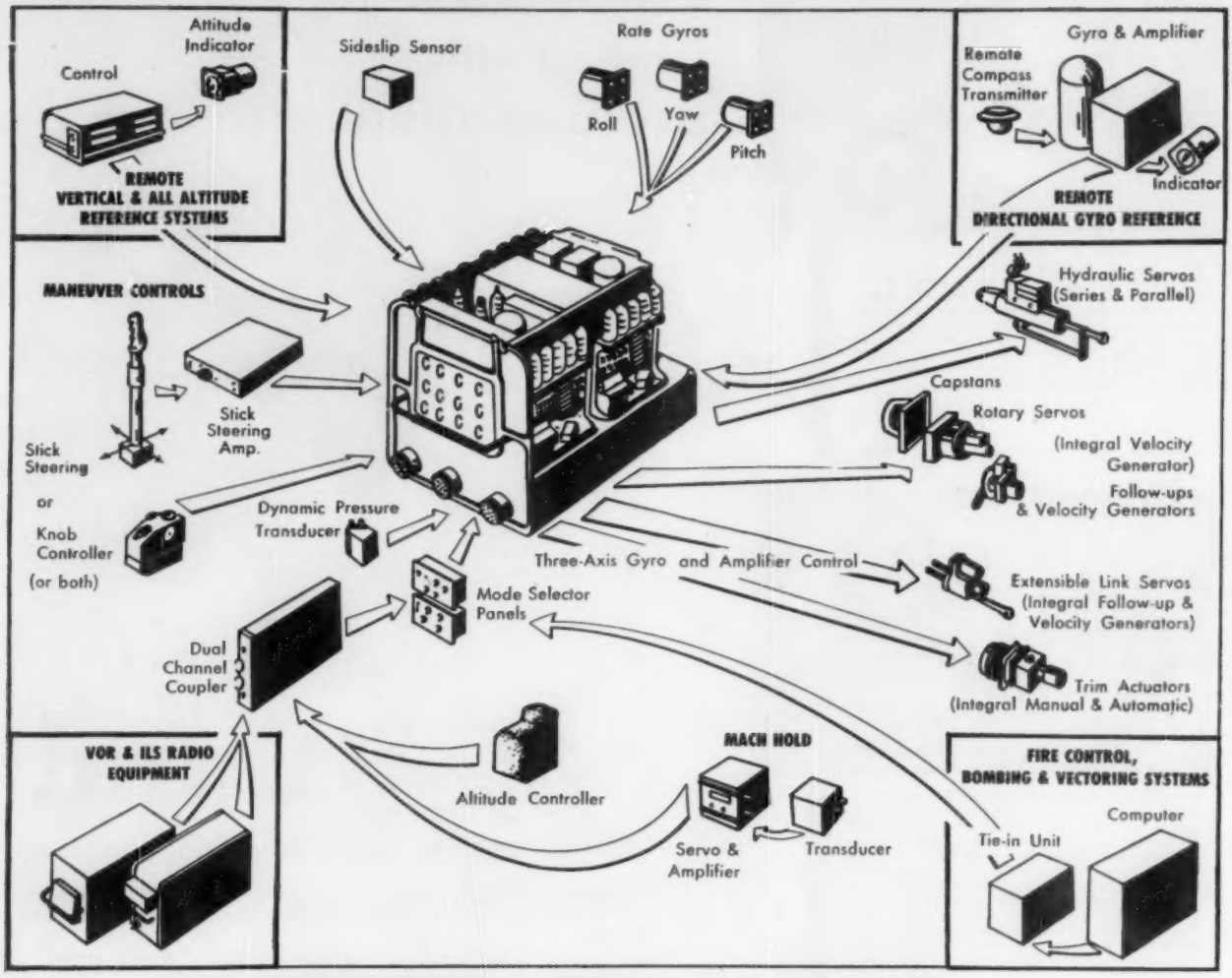

SCHEMATIC OF LEAR L-10 AUTOMATIC FLIGHT CONTROL SYSTEM

Life of F-5 Autopilot Design Stretched as . . .

Lear Bases L-10 on Proven Components

By Philip Klass

In the field of fighter-interceptor autopilots, where obsolescence is a serious occupational hazard because of fast-increasing plane speeds and new tactical roles, the Lear F-5 has enjoyed unusual longevity. Now, by means of a new advanced system called the L-10, developed for supersonic aircraft, Lear expects to extend the useful life of its basic F-5 design by several years.

There are many advantages to stretching a basic proven design, as Douglas and Lockheed can testify with their basic DC-6 and Constellation airframes. In the case of Lear's L-10, some of these advantages are:

• **Already debugged.** Thousands of F-5 components have been produced, debugged, and proven in the field. This should spare the L-10 many of the headaches that normally accompany a new system design.

• **Already tooled.** Much of the present F-5 tooling can be used, cutting manufacturing costs and enabling the company to offer speedier delivery to a potential customer.

• **F-5 upgrading.** Existing F-5 autopilots now in use can be upgraded to L-10s without too much effort or cost.

• **Maintenance simplified.** Present USAF maintenance personnel, trained on F-5s, can be schooled easily to handle the L-10.

► **More Than Autopilot**—The L-10 is more aptly described as an automatic flight control system than as an autopilot. It provides stability augmentation (dampers) for all three airplane control axes, if required. The L-10 also is designed to tie into panel instruments to eliminate previous duplication of directional and attitude gyroscopes.

The L-10, like the recently announced Minneapolis-Honeywell E-10 (AVIATION WEEK Nov. 1, 1954, p. 60), is in reality a series of building blocks from which autoflight control systems can be tailored for a variety of fighters, interceptors, bombers, or transports, Lear says.

► **Trial Installations**—The L-10, which has been tested in a Republic F-84E, will soon be installed on a North American F-86D and an F-84F for Air Force evaluation.

The F-84F now is equipped with an Air Force type MB-2 autopilot which

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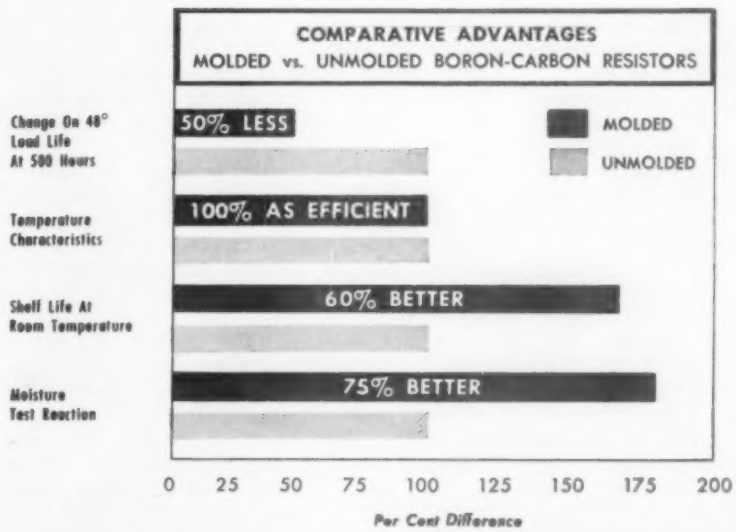

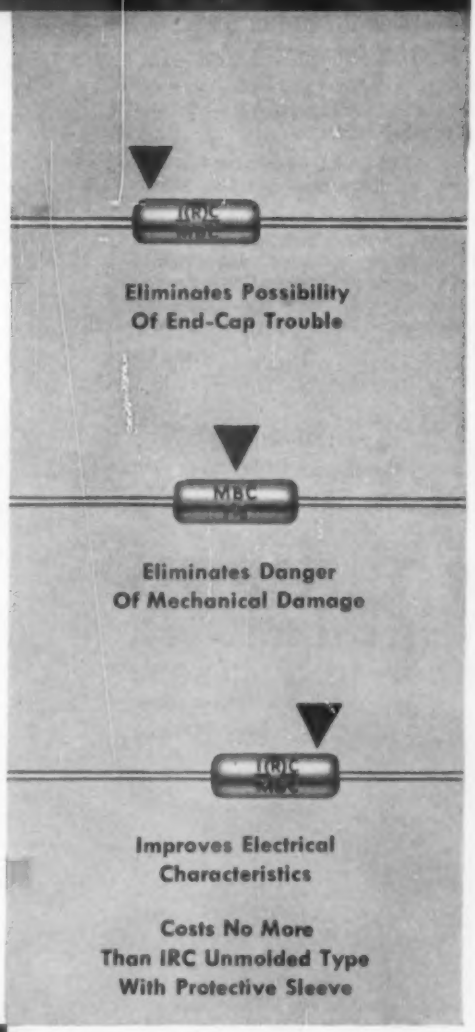

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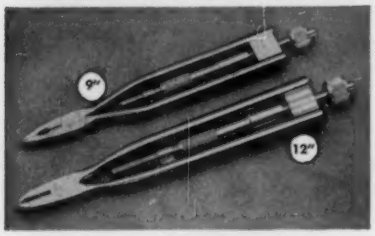

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F-84F AUTOPILOT is now the MB-2, but the L-10 will soon be tried in this plane.

might be termed an "L-7½" because it has certain features of both the F-5 and the new L-10. When Lear was called in on short notice to supply an autopilot for the F-84F, there was not sufficient time to produce a full L-10. (Lear is proud of the fact that it was delivering production MB-2s three weeks after it signed the contract.)

The MB-2 is slated for trial installation soon on a Martin B-57 bomber and on a reconnaissance version of the F-84F.

► **L-10/F-5 Differences**—Here are some of the basic differences between the L-10 and the older F-5:

• **Duplicate gyros eliminated.** There is considerable duplication of gyroscopes on present-day military aircraft, particularly interceptors. For instance, some interceptors have up to five separate vertical gyros, each used for a separate function, including panel indication, flight director, fire control computer, autopilot, and radar antenna stabilization. If any one fails, its associated equipment is incapacitated.

In the new L-10, the vertical and directional gyros are eliminated and the system is designed to take its attitude signals from the widely used Lear VGI panel horizon indicator, and its heading signals from the widely used type N-1 low-drift panel-indicating remote gyro system, or a low-drift Lear unit which Navy BuAer recently contracted to buy.

• **Stable platform reference.** Lear has developed several gyro-stabilized platforms which could serve as a master reference for the L-10 as well as provide signals for panel instruments, fire control and bombing systems. A pair of stable platforms installed in an airplane would give complete standby provisions, increasing overall reliability and cutting weight by further elimination of individual gyros. The stable platform, with its unlimited maneuverability, also would prove an ideal reference for vertical takeoff aircraft.

• **Rate gyros added.** Three rate gyros have been added to provide stability augmentation for all airplane axes during manual flight and to facilitate the tie-in with interceptor or bombing fire control systems. The rate gyros are located in the amplifier in the space vacated by the F-5 vertical and horizon gyros.

• **Higher amplifier gain.** The addition of tachometer (rate) generators to provide signals proportional to rate of servo output shaft deflection, plus circuit design changes, enable the L-10 amplifier to provide 10 times more usable gain than the F-5, Lear reports. The result is increased accuracy in positioning control-surfaces, an important consideration for stable control at and above sonic speed.

• **Mach number control.** In addition to barometric altitude control provided in the F-5, the L-10 offers another mode of operation—automatic Mach number control, which operates the plane's elevators to maintain it at a constant speed.

• **Aileron heading control.** Further to facilitate interceptor fire control tie-in, the L-10 hearing control signals are introduced into the aileron instead of the rudder channel as in the F-5. The rudder, taking its signals from a new sideslip sensing accelerometer, functions to provide "centered ball" coordinated flight during all maneuvers, both for automatic and manual flight.

• **Control stick steering.** The increasingly popular control stick steering, which enables the pilot to maneuver through the autopilot using the plane's regular control stick (or column), is provided. The airplane responds much as it would under manual flight, except that it remains stabilized at its new attitude when the pilot releases the stick. Especially important for low-altitude, highspeed maneuvers, control stick steering can be provided by itself, or in addition to the standard F-5 type of knob-controller.

• **Bombing and fire control tie-in.** The

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Up where summers are cold and winters colder, where days are long and nights seem longer, U. S. Air Force men in Northrop Scorpion F-89 interceptors stand all-weather guard along our northern frontier. These reliable bomber destroyers fly through icy fog, storm and blackness to give around-the-clock protection to the heartland of America. Northrop Scorpions have speed to intercept invading aircraft, the endurance and firepower to follow, harass, and destroy them long before they can reach their intended target. F-89's are one of many contributions to national defense made by the experienced engineering and production complex of Northrop Aircraft, Inc., America's first company in the vital design, development and production of all-weather and pilotless aircraft.

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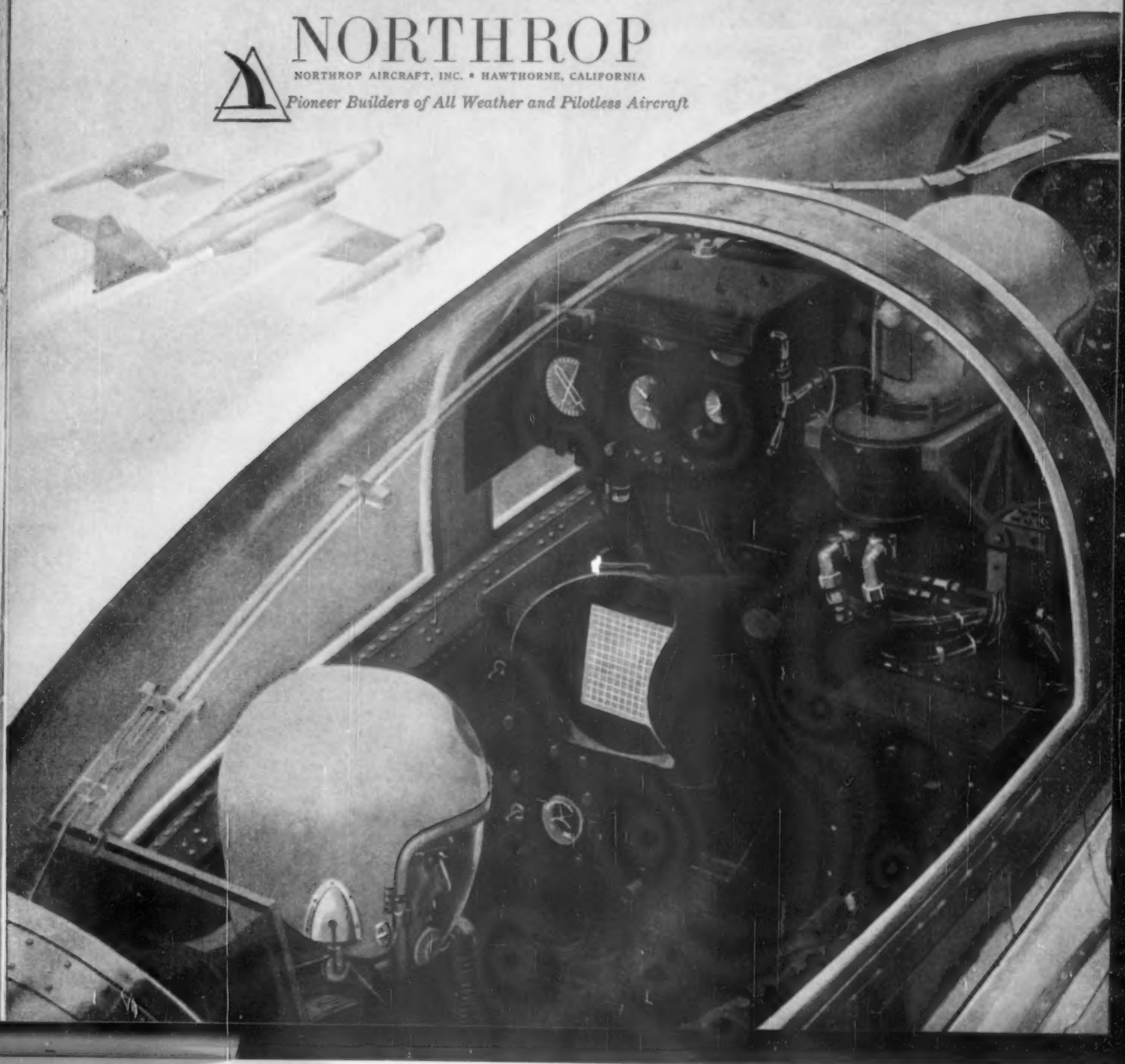

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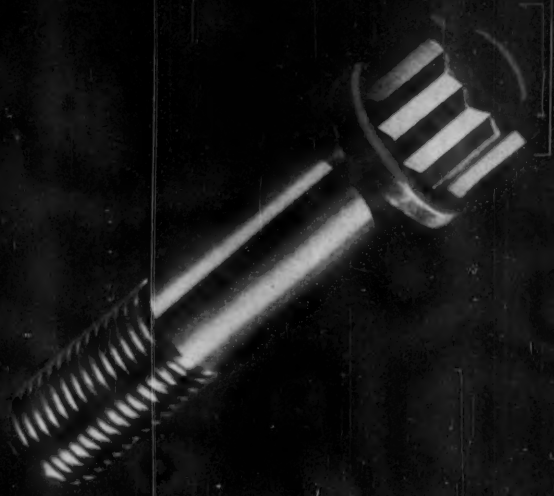

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L-10 is designed to maneuver the airplane in accordance with signals generated by several types of bombing or interceptor fire control systems.

• **Automatic heading selector.** One mode of operation, particularly useful for interceptors under ground-controlled intercept (GCI) command, enables the pilot to pre-select any desired airplane heading authorized by GCI.

When he pushes a button, the plane takes up that heading. The pilot can alter the pre-set course, even after he has pushed the button, by means of the same heading selector.

An alternate mode of operation makes use of an automatic leveling feature in the L-10. If a pilot gets lined up on his target while in a turn, he need only push another button and the plane automatically will level out on the exact heading it had at the moment the button was pushed.

• **Omnirange flying.** The new L-10 navigational coupler provides for automatic omnirange flying in addition to the usual ILS automatic approach feature.

• **Automatic trim control.** The L-10 provides automatic operation of trim controls to remove steady-state loads on the control surface (if the plane has trim tabs) or on the control stick (if the plane has a boost system). A novel two-speed trim servo eliminates the need for using separate trim servos for manual and automatic trimming.

• **Hydraulic servos.** Lear has designed a family of electrically controlled hydraulic servos to handle either parallel or differential-type actuator installations and a variety of power requirements, if hydraulic servos are desired. Where higher powers are needed, a two-stage valve is used in which an electric torque motor actuates the first stage, which in turn positions a slave valve which controls the flow to the actuator.

The parallel-type actuator has bypass valves to free the piston automatically in the event of loss of hydraulic pressure. The differential-type actuator has provisions for locking the actuator in event of malfunction.

▶ **Familiar Faces**—In appearance, the L-10 main amplifier resembles that of the F-5. Small plug-in amplifiers are clustered around the main chassis as in the F-5. Some of the other familiar F-5 components easily spotted in the L-10 include:

• **Powered magnetic clutch** servos with continuously running motors which combine with the high-gain amplifier to give fast response.

• **Automatic gain compensator,** which varies system parameters as a function of airplane speed and air density.

• **Automatic cut-off,** which disengages autopilot when confronted by malfunctions that would apply large hardover signals to the servos.

▶ **Weight Comparison**—Integration of the L-10 with the attitude and directional references of other systems aboard enables the new autoflight control to provide its increased functions without appreciable increase in weight over that of the lightweight F-5. If the plane requires stability augumentation in one or more axes, the L-10 actually results in an attractive weight saving, Lear says.

Although system weight varies with the particular installation, the L-10 scheduled to go into the F-84F will weigh 63 lb. (uninstalled) including approach coupler, Lear reports.

New Atlantic Net Uses Ground Waves

A big improvement in the reliability of high-frequency ground-air radio communications is in prospect for airliners plying the North Atlantic routes when a new radio network employing ground-wave transmission is completed in the next few months. Sky-wave transmission, presently employed, is frequently interrupted by sun spots and other auroral phenomenon.

The new network, pioneered by Pan American World Airways, is expected

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Weights

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Engineering Personnel
NORTH AMERICAN AVIATION, INC.
12214 Lakewood Blvd.
Downey, California

to provide effective communications more than 95% of the time. The new stations are located at Torbay (Newfoundland), Grindavik (Iceland) and in the Hebrides.

▶ **Started in 1952**—Initial PAA investigation of ground-wave transmission began in 1952. A trial installation on Long Island confirmed that ground waves suffered relatively little absorption over water, unlike transmission over ground, if a vertically polarized antenna is used and installed near the water's edge.

In August of that year, in cooperation with the Canadian Department of Transport and Trans-Canada Air Lines, PAA's Paul Rafford set up a listening post at Torbay.

Rafford found that ground wave signals from aircraft up to 600 miles away could be received when a conventional sky-wave station at Gander was either out of contact or had difficulty receiving the aircraft transmission. During a six-day period, there were 90 incidents where Gander could not communicate with aircraft or had difficulty in doing so.

With the cooperation of the USAF, which was interested in the project, a ground-wave station was installed on desolate Simiutak. During a two-week test period, the Simiutak station maintained solid coverage up to 500 miles, even during two days when sky-wave communication was completely blacked out, PAA reports.

Following these tests, the Icelandic and British governments were approached and arrangements were made for the Grindavik and Hebrides installations. The former is now complete and the latter is nearing readiness.

▶ **Rafford Cited**—In recognition of Rafford's work on ground-wave communications, he recently was awarded a citation by the North Atlantic Radiotelephone Committee (Nartel) as the man who had contributed most toward the development of radio telephone along the Atlantic route during 1953.

Nartel represents all the major trans-Atlantic airlines.

Devices Speed Test Of Avionic Units

A highspeed automatic tester which can be used to sort resistors into several groups depending upon their individual resistances, is one of several new devices suitable for production line testing of avionic components.

The new resistor sorting bridge, Type 32S, can check resistors from 1 ohm to 30 megohms, at the rate of 7,500/hour. It consists of a Wheatstone bridge and sensitive balance detector with relay output.

The manufacturer, Barnes Development Co., has also announced a deviation bridge, Type 38R, which can be used to compare the value of a resistor to a predetermined standard, giving an automatic indication of the percent deviation from the standard. Device can be set to actuate relays at two different deviation values on each side of the nominal value.

Address: 213 W. Baltimore Pike, Lansdowne, Pa.

Other new production testers include:

• **Tube tester,** designed specifically for production testing to MIL-E-1B Specs. Device, which contains its own regulated power supply and precision meters, may also be used for engineering analysis of tube characteristics. Manufacturer: Rheem Research and Development Labs, 9236 E. Hall Road, Downey, Calif.

• **Rotary accelerator,** Model T-16A, can be used to subject devices to accelerations of up to 100G. Accelerator can handle samples which weigh as much as 500 lb. Sixty sliprings transmit power and signal voltages to rotating member and test sample. Unit operates from 440-v., 60-cycle, 3-phase power. Manufacturer: Schaevitz Machine Works, Camden 1, N. J.

• **Digital voltmeter,** Model 519, measures d.c. voltages from 0.001 to 999.99, with maximum error of less than 0.01% or 0.001 volts, whichever is greater. Instrument can make 75 readings a minute with automatic visual indication of polarity and decimal point position. Manufacturer: Non-Linear Systems, Inc., Box 728, Del Mar, Calif.

FILTER CENTER

▶ **On the Threshold**—General Electric's Heavy Military Electronics Equipment department is "on the threshold of electronics advancements which . . . will increase further our military defensive and offensive capabilities," according to Dr. W. R. G. Baker, general manager of GE's Electronics Division. These include: "volumetric scanning radar, air surveillance radar, height-finding radar, guidance and control mechanisms and communications," Baker says. Shipments of airborne avionics equipment by GE's Light Military Electronics Equipment department during 1954 were at the highest level since World War II, Baker declared.

▶ **Narco Steps up DME Production**—National Aeronautical Corp. reports that it is stepping up production of its model UDI-1 distance measuring equipment to two sets per day. —PK

J. L. ADRIAN, CHIEF PROPELLER DESIGN ENGINEER, PROPELLER DIVISION, CURTISS-WRIGHT CORPORATION, CALDWELL, N. J.

G-E aircraft motors meet C-W's toughest specs

"When Curtiss-Wright was developing its now famous Electric Propeller," says J. L. Adrian, Chief Propeller Design Engineer of the company's Propeller Division, "it faced very strict design requirements. For instance, C-W needed a propeller pitch-changing motor that would function with precision under the rigors of combat military service—extremes of altitude, temperature, vibration, shock, and centrifugal force.

"Then G-E engineers were called in. They came through with a basic motor design that not only met Curtiss-Wright's toughest specifications but, with variations, has been used in 55 different Curtiss Propeller applications since—on such planes as the B-50 Superfortresses, C-124 Globemasters, and DC-6, CV-240, and Constellation transports."

IN SERVING YOU, G-E engineers can draw on unmatched experience gained in solving this and many hundreds of other aircraft motor problems. In addition, they'll have at their disposal complete aircraft motor development and testing facilities.

To take full advantage of this service, contact your local G-E Apparatus Sales Office *early in your planning*. And, for more information, write today to Section 704-30, General Electric Co., Schenectady 5, N. Y.

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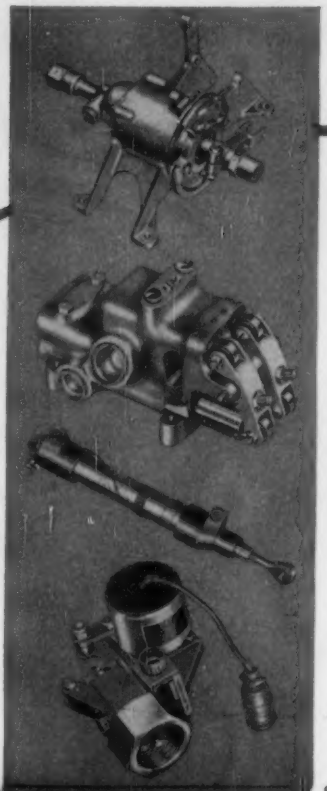

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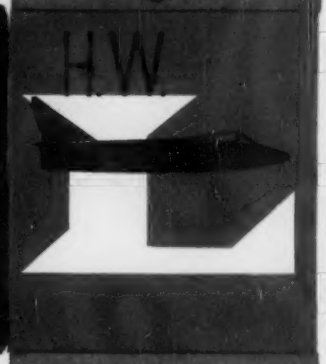

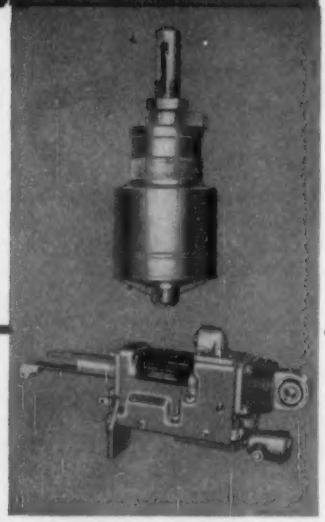

Space and performance requirements have made it more and more necessary to produce specialized components for modern aircraft. The so-called standard piece of equipment often forces a compromise. Here are two typical tough jobs:
...Fuel tank air pressure regulating valves which flow up to 100 cfm of up to 450° F. air and controls pressure within a range of less than one psi.
...A brake control valve which senses the pilot's control forces over fifty feet away and controls hydraulic pressure at the brakes, 125 feet away.
The ability of Haskel Engineering and Loud Production to build special purpose equipment to meet the exacting demands of this industry have made Loud an outstanding producer of the "out of the ordinary" hydraulic and pneumatic equipment.

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Whiting for a one-year trial basis.

three dollies which are in the "out"

plane sideways the 90 ft. to the dock

DC-7 LANDING GEAR rests in cars that move plane sideways along tracks to . . .

LOADAIR DOCK from which passengers enter plane without leaving cover of terminal.

Loadair Dock Goes Into Operation

Cost of experimental Whiting installation at Idlewild is being underwritten for a year by the manufacturer.

By George L. Christian

Recent installation of a Whiting Loadair mechanical airplane docking device at New York International Airport marks the first use of the equipment in the U.S. (AVIATION WEEK Dec. 27, 1954, p. 7). A similar unit, in operation for several years at Soledad Airport, Barranquilla, Colombia, has saved Avianca 50% in ramp time, according to Whiting.

▶ **Idlewild Details**—Here are some details about the New York installation at Idlewild:

• **Loadair tows an aircraft sideways** on dollies for a distance of 90 ft. to position it close to the loading dock. This allows passengers to board or leave the plane without being exposed to inclement weather (dollies are flush with the ramp and ride on sunken tracks).

• **Installation was made entirely** at the expense of the Whiting Corp. for an approximate total cost of $90,000 (some $60,000 went into building erection and installation, $30,000 into Loadair machinery). The Port of New York Authority gave technical assistance.

• **Responsibility for upkeep** and maintenance rests entirely with the Whiting company.

• **Dock is installed** at Gate 4, adjacent to American Airlines' facilities where it will be used by AA and other carriers.

• **Experiment was underwritten** by

Digital Communication Engineers

with experience in the fields of

Systems Engineering
Miniaturization
Circuit Development
Electromechanical Development
Digital Techniques

Long-Range Information Transmission

New advancements in the field of long-range information transmission are being made at Hughes with digital techniques.

Areas of Work

To further expand work in this area, Hughes Research and Development Laboratories are interested in people with experience in airborne communication systems, digital storage, low frequency measurements, modulation systems, miniaturized packaging, audio, IF and RF circuitry in the HF range, analog to digital—and other data conversion methods.

Scientific and Engineering Staff

Hughes
RESEARCH AND DEVELOPMENT LABORATORIES

CULVER CITY, LOS ANGELES COUNTY, CALIFORNIA

Relocation of applicant must not cause disruption of an urgent military project.

Whiting for a one-year trial basis.

• **Installation took 2½ months** from ground breaking to completion.

▶ **Technical Details**—Whiting says the two-story dock is designed to board passengers on large, tricycle landing gear planes from the top deck, while passengers for smaller and tail-wheel aircraft board from the ground deck. Lower level is also used for baggage reclaim and ticket check-in prior to boarding aircraft.

A conveyor belt, moving at 150 ft./min. takes baggage to and from aircraft. Belt is covered to protect baggage from the weather.

In operation, an aircraft taxis on to three dollies which are in the "out" position, 90 ft. from the dock. Trucks for the main gear have been separated to correspond with the airplane's landing gear tread. Nose wheel truck is positioned on one of nine tracks to correspond with the wheel base of the airplane.

With tail-wheel aircraft, the two main gear are rolled on to the main dollies and the tail wheel allowed to swivel.

As soon as the plane is positioned, gates on the trucks are raised to prevent main gear wheels from rolling off the dollies. A push-button starts an electric motor which drives a winch to pull the plane sideways the 90 ft. to the dock in less than a minute. Power is applied to main dollies only; the nose dolly moves freely.

▶ **Wet Demonstration**—Whiting officials, in conjunction with American Airlines and PNYA, gave a press preview of the Idlewild Loadair recently. A driving rain storm and gusts up to 50 mph. gave correspondents a first-hand experience of how effectively the Loadair allows passengers to board an aircraft with only a second's exposure to the elements as you step from dock to plane. And you do not have to wade through ankle-deep water on the ramp to get to the ship.

When plane was towed away from the dock, starting and stopping was smooth. However, the underground cable driving the main dollies stretched and came off the pulley which is located at the far end of the track, causing a delay. Also, the limit switches got out of adjustment so that the plane did not stop where it should have on the return trip and had to be repositioned before disembarking was possible. However, Whiting said these "bugs" will be ironed out easily.

▶ **Electrical Operation**—All electrical equipment used with the Loadair dock is manufactured by the Westinghouse Electric Corp.

Among the components supplied by Westinghouse are a main, 20-hp. drive motor which operates the winch to move the airplane 90 ft. in 40 sec. at an electrical cost of less than 1¼¢ per operation, and three explosion-proof motors, which power the baggage conveyor belt at 150 ft./min.

Electrical power from a three-phase, 208-v., 60-c. line supplies the Westinghouse electrical control panel through a main switch.

Movement of the plane is controlled through four push-buttons, one at the upper platform level, one at the main dock level and two on the ramp. Ramp control buttons move the plane along the tracks at 150 ft./min. until it is six feet from the dock, at which point it is "inched" into position at 30-ft./min. maximum through an "inching" button.

As plane reaches the dock, a limit switch contacts the plane's fuselage and plane stops. Limit switches connected directly to the winch stop the plane in the correct "out" position.

One operator is required per pair of buttons. If either releases his button, the Loadair shuts down, as a safety measure.

A Whiting spokesman says that the Idlewild Loadair has been handling about three aircraft movements a day since its inauguration last Dec. 15 and has been giving perfect service. American says passenger reaction has been excellent.

Housing intricate electronic equipment for airborne use to withstand shocks and forces which might cause malfunction often presents problems as difficult as the design of electronic systems themselves.

Take one example—a pressurized external housing capable of being flown in the trans-sonic speed range and meeting all environmental trials. From wind tunnel tests to complete tooling and manufacture, Edo relieved the electronics manufacturer and aircraft builder of the many problems involved.

If you have an external stores housing problem, no doubt our vast experience in both electronics and aerodynamics can help you.

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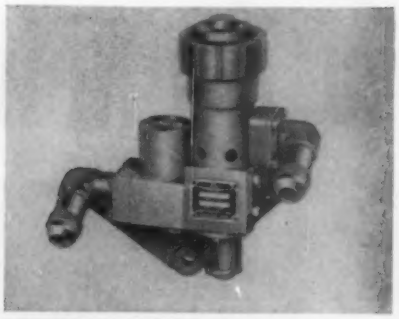

REGULATOR operates over wide range.

Anti-Blackout Suit Valve Gives Automatic Regulation

New pressure-regulating valve for anti-G suits operates completely automatically.

The valve takes air from a jet engine compressor bleedoff, or other compressed gas source, and automatically provides air at the correct pressure required in the pilot's anti-G suit to prevent blackout during periods of positive acceleration.

The valve is designed to accommodate inlet pressures of from 10 to 350 psi. and temperatures from −65 to 400F. It can be adjusted for low and high increments of pressure.

Alar Products, Inc., 1071 Power Ave., Cleveland 14.

CONTROL PANEL has flexible design.

J&H Develops Aircraft A. C. System Components

Two new advances in aircraft a.c. electrical systems—one a line of control panels that can be readily tailored by airframe manufacturers to the electrical system of any plane and the other a new circuit breaker—have been developed by Jack & Heintz, Inc.

▶ **Four Basic Panels**—The panels have been designed to applicable USAF-USN specs and because of their flexible layout can be stripped down to include only those components required by a particular electrical system. If a manufacturer prefers a component system to the panelized, J&H can furnish control and protective components individually.

Where d.c. power is available for control power, there are two basic panels. One is for single-generated systems (isolated); the other is for multi-generator (parallel). Both panels will operate if the d.c. supply fails.

Where d.c. is not available, there are two other basic panels: one for isolated and one for parallel systems.

Most common panel assembly involves mounting control and protective elements on a sub-panel, which in turn is shock-mounted on the main panel. The assembled panel can be furnished for rack, bolt-down or inject-eject tray mounting. A plug-in type connector is used to connect wiring. A handle can be provided at the front and test jacks are available as accessories.

▶ **Circuit Breaker**—Meeting the dimensional and performance specs of MIL-C-8379 and weighing 4.5 lb., the new circuit breaker, designated GC86, has a balanced rotary latch employing the "over-center" principle to insure that the device will stay latched in extreme shock conditions.

Solenoid-actuated contacts obviate need for levers or highly loaded bearings for actuation. Absence of high-force fulcrums and molded plastic contact actuation points eliminate wear, J&H points out. An interlock relay provides a positive anti-pump circuit, making adjustment of interlock contacts non-critical. Main contacts can be inspected

RESOLVED MOODBEAMS #2

In making New Year Resolutions, why not string along with Yvonne Erwin (21, 5'7", 118 lbs., brown eyes, brown hair), MISS TEXAS OF 1954? She has tasseled a tip to remember what she disremembered last year — whatever that was — and, with a woman, who knows? With a pilot, tho, it may have been Southwest Airmotive de-icing, anti-icing, or heater service. Resolve now to profit from SAC's extra margin of safety and reliability in new installations, periodic checks, and repairs!

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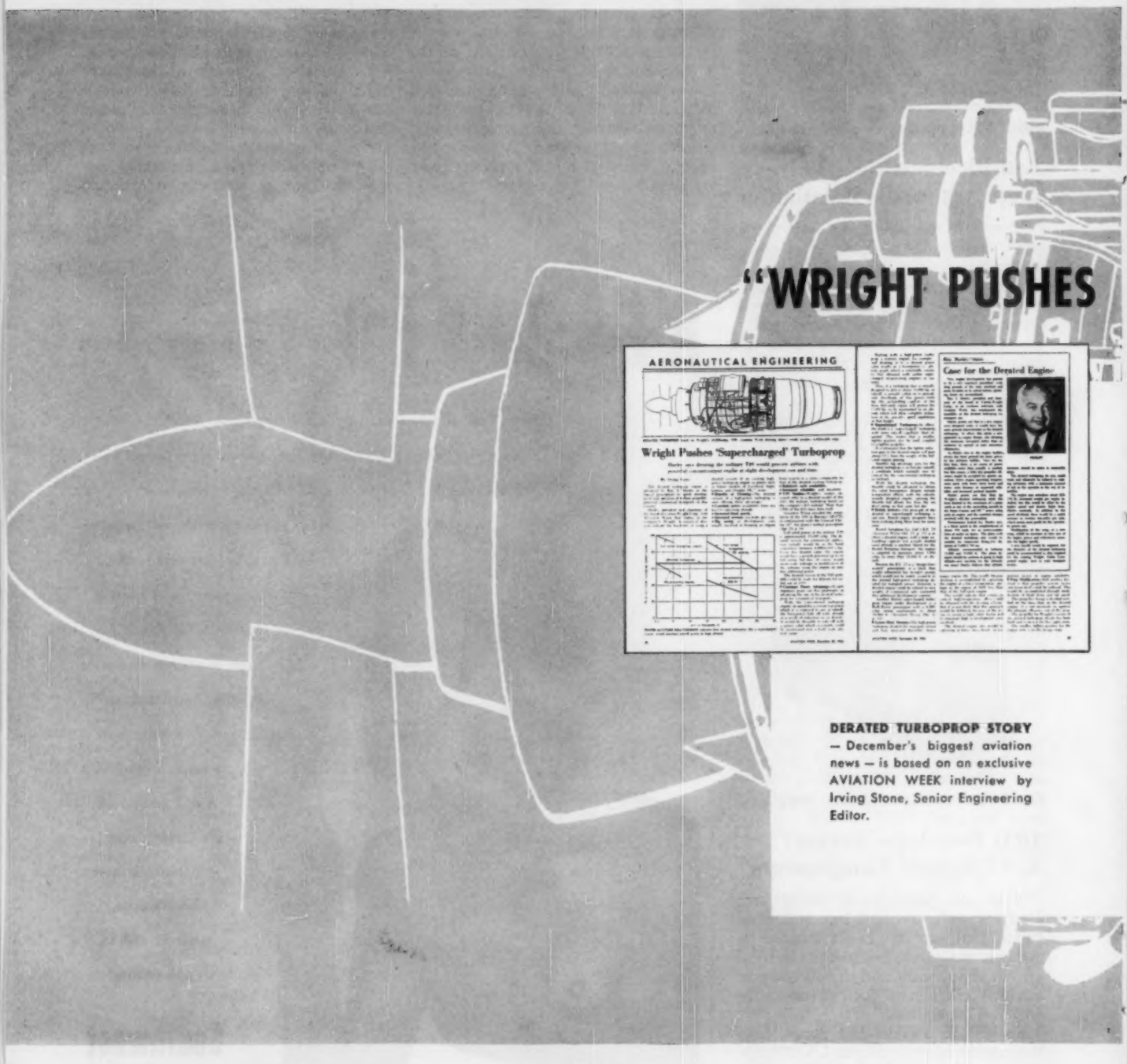
The Biggest Aviation News



"WRIGHT PUSHES

AERONAUTICAL ENGINEERING

Wright Pushes 'Supercharged' Turboprop

Case for the Derated Engine

DERATED TURBOPROP STORY — December's biggest aviation news — is based on an exclusive AVIATION WEEK interview by Irving Stone, Senior Engineering Editor.

AVIATION

McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 36, N. Y.: Other Advertising Sales Offices: **Atlanta 3, Ga.,** 801 Rhodes-Haverty Bldg. **Boston 16, Mass.,** 350 Park Square Bldg. **Chicago 11, Ill.,** 520 N. Michigan Ave. **Cleveland 15, Ohio,** 1510-Hanna Bldg. **Dallas 1, Texas,** First

for December!

IRVING STONE, AVIATION WEEK Senior Engineering Editor, holds a Mechanical Engineering degree from Polytechnic Institute of Brooklyn, and the degree of Doctor of Jurisprudence from New York University. Mr. Stone was Supervisor of Training Literature at Air Force Technical School, Chanute Field, Ill. in 1941-42. He served as Chief of Instructional Materials at Air Force Technical School, Seymour Johnson Field, N. C., 1942-44. As Assistant Chief Instructor at the same field in 1943-44, Mr. Stone supervised 2,500 civilian and enlisted instructors and some 25,000 student mechanics. Mr. Stone was Administrator, Department of Plans and Training, Air Force Engineering Cadet Course, Yale University, 1944. He joined the staff of AVIATION magazine, AVIATION WEEK's predecessor, in 1944, and later served as Engineering Editor of AIR TRANSPORT. Mr. Stone is a member of the Institute of the Aeronautical Sciences and Aviation Writers Association.

'SUPERCHARGED' TURBOPROP"

AVIATION WEEK's engineering articles are the product of the largest staff of graduate engineering editors serving any aviation publication. That is why more management and engineering people prefer* AVIATION WEEK by a wide margin than any other aeronautical magazine. This story by Irving Stone, Senior Engineering Editor, written from an exclusive interview, serves as another illustration of AVIATION WEEK's on-the-spot coverage of important technical developments.

In this fast-moving aviation business, engineers and management men want to get their engineering information delivered to them while it is still news, not months later. They need this information to make daily decisions affecting the defense of the nation and the well-being and progress of the country's largest single business – aviation. These men have learned long ago that it is only through the fast publishing schedule of AVIATION WEEK that these important requirements can be met.

*Based on independent reader preference studies.

WEEK

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without disassembling the breaker.

Jack & Heintz, Inc., 17600 Broad way, Cleveland 1, Ohio.

Alarm Makes Operation Of Tester Near-Automatic

A new signaling and recording attachment for the Sperry Reflectoscope, used for non-destructive testing, sets off a visual or aural alarm when defects are detected, making operation virtually automatic, the manufacturer points out.

With the attachment, the operator does not have to watch the Reflectoscope's cathode ray screen. It is attached to the equipment by four bolts and has interconnecting cables. Designation is the Type RA signalling and recording attachment.

Sperry Products, Inc., Danbury, Conn.

Lightning Arrester Guards Air Communications Gear

Costly communications gear on commercial and military aircraft is protected from destructive effects of lightning strikes by new lightweight arrester.

The arrester is a hermetically sealed stainless steel case to which is attached

DEVICE PULLS FANGS of lightning bolts.

a Pyrex glass standoff insulator. A capacitor in the arrester in series with the RF transmission line presents a high transient impedance to the lightning impulse, which therefore arcs across three adjustable spark gaps located around an aluminum rod in the center of the glass cap. Condition of the gaps may be inspected through an observation window. When necessary, the spark gaps and other components may be replaced and the unit re-used.

The unit is designed for maximum RF energy transmission in the 2-24 mc. band. It will not flash or indicate corona up to 10 kv. within this band. Weight of the arrester is 6.5 lb. It is mounted within the aircraft's shell, so will not increase drag.

It is said to be suitable also for antenna tower installation.

Airtron, Inc., Dept. A, 1103 W. Elizabeth Ave., Linden, N. J.

ALSO ON THE MARKET

Televac vacuum measuring instrument measures approximately 2x2⅜x4 in., weighs about 1 lb. and is inexpensive, maker notes. Operating range: 1-1,000 microns Hg.—George F. Fredericks Co., Dept. S, 507 Ann St., Bethayres, Pa.

Draftsman's Ellipsograph enables the novice to transpose orthographic flat plans to pictorial drawings with perspective. Ellipses of any desired size and degree are possible, using the self-calculating charts provided. Instrument is made of machined steel, working parts are chrome plated. Model A-140 costs $22.50.—Fowler Engineering Co., 1109 Maple St., Whittier 2, Calif.

75%

of all the helicopters flying today have

Franklin POWER

Franklin engines have powered 75% or more of all the helicopters ever built. As in previous years, Franklin engines were used **exclusively** in 1954 in the only CAA-certificated helicopters under 400 h.p. in quantity production—the Bell 47G and the Hiller 12B—and will continue to power these models in 1955, as well as the Bell 47HI. Franklin engines have now logged over 1,250,000 hours in Bell and Hiller helicopters alone.

Franklin's unmatched experience in helicopter power is at your disposal—as are our excellent facilities for subcontracting precision machining and sub-assemblies of the highest quality.

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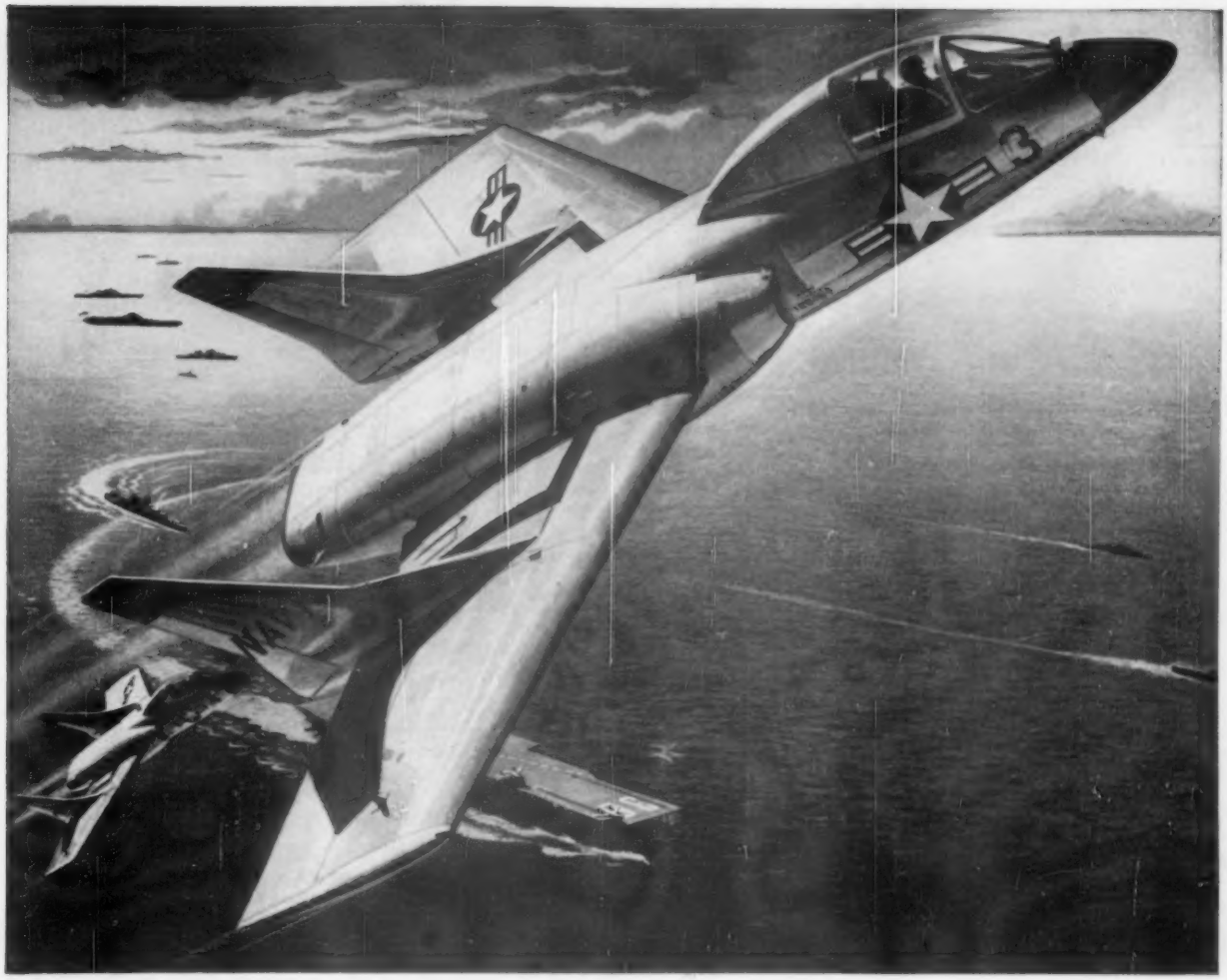

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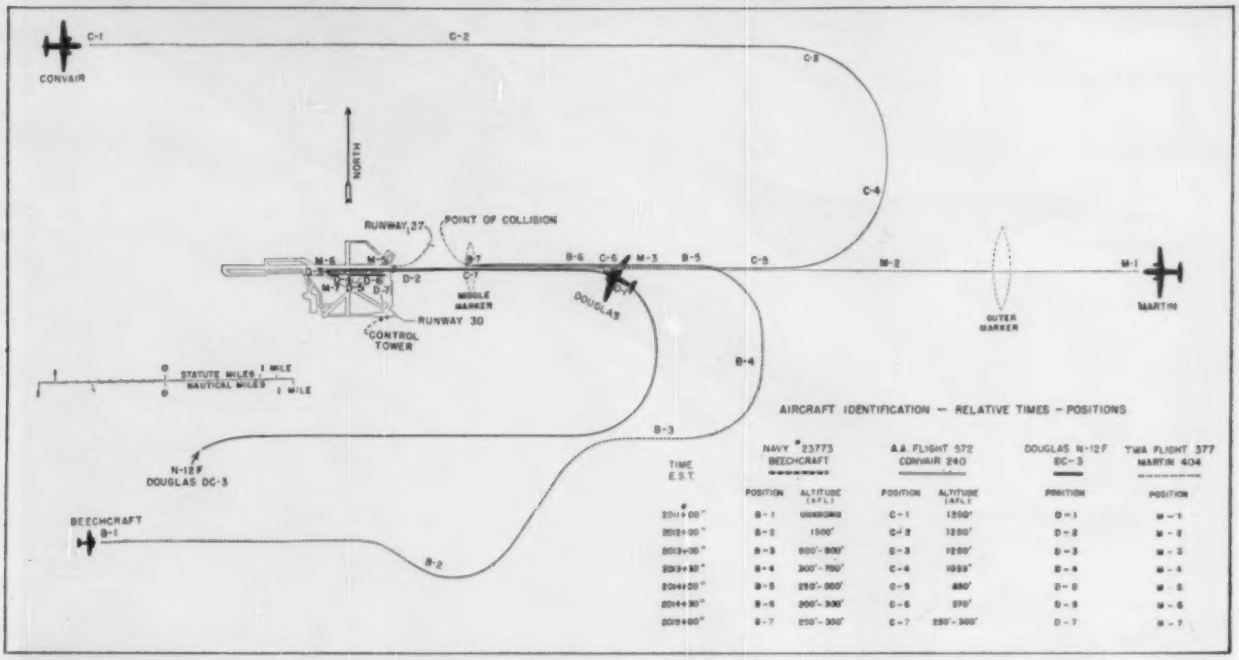

PROBABLE FLIGHT PATHS of aircraft in relation to Port Columbus Airport prior to collision between Convair and Beechcraft.

Official CAB Accident Investigation Report

Tower and Crews Blamed for Collision

THE ACCIDENT

American Airlines Flight 572, a Convair 240, N 94236, and a United States Navy SNB, Bureau Number 23773, collided 0.6 mile east of the Port Columbus Airport, Columbus, Ohio. The collision occurred at 2015[1], June 27, 1954, while both aircraft were on final approach to Runway 27.

The SNB caught fire at impact, crashed and burned, fatally injuring the only two occupants and destroying the aircraft. The Convair continued its approach and landed. During the landing roll the Convair nose gear collapsed and the aircraft slid along the runway on its nose section. None of the 32 passengers, including 1 infant, or 3 crew members was seriously injured. Two small fires in the Convair were quickly extinguished; the aircraft received major damage.

HISTORY OF THE FLIGHT

American Airlines Flight 572 of June 27, 1954, was a scheduled operation between Memphis, Tenn., and Cleveland, Ohio, with intermediate stops, one of which was Columbus, Ohio. The crew assigned at Nashville, Tenn., to continue the flight consisted of Capt. J. C. Pollard, First Officer J. S. Myrick, and Stewardess M. J. Gunn. Weather conditions were good over the entire route and the flight was conducted in accordance with visual flight rules.

[1]All times herein are Eastern Standard Time and are based on the 24-hour clock.

Departure from Dayton, Ohio, the scheduled passenger stop immediately prior to Columbus, was at 1952 with First Officer Myrick flying the aircraft from his right seat position. The aircraft was loaded to a gross weight of 37,664 lb., 2,709 lb. less than the maximum allowable and the load was properly distributed. About 10 minutes after departure Capt. Pollard, performing the duties of co-pilot, reported to the company radio that he was "in range," and advised he was changing to the Columbus Tower frequency, 121.1 mc.

At approximately 2007 the flight contacted the tower advising it was about 6 miles west of the Hilliard fan marker (located 12 miles west of the airport). The tower gave landing information and approved a requested right traffic pattern to Runway 27. The flight, at reduced power, began a shallow descent from its cruising altitude of 3,000 ft. MSL (mean sea level). Its flight path was slightly north of the fan marker and slightly north of the business district of Columbus at an indicated airspeed of 185 knots.

First Officer Myrick established a downwind leg 1,200 ft. above the ground and approximately 2¼ miles northwest of the airport. During the downwind leg the aircraft was slowed to approximately 160 knots with 16 degrees of flaps extended. The tower gave the flight a landing sequence of number 2 following a TWA Martin, Flight 377, which was then making a straight-in approach to Runway 27.

In order to establish a normal interval behind Flight 377, First Officer Myrick extended the downwind leg until approximately opposite the TWA Martin. He then began a right descending turn for the approach to the runway. The turn was made gradually, slowing the aircraft to 140 knots during the turn. The turn was completed about 850 feet above the ground and about 3½ miles east of the runway threshold.

The approach was made in a normal descent and with a continuous reduction of airspeed. The average airspeed for the approach was about 135 knots. When approximately 0.6 mile from the runway and about 300 ft. above the ground the crew felt a violent jar and simultaneous yaw of the aircraft to the left. Capt. Pollard took control, noticing the left engine was stopped. Together with First Officer Myrick he realigned the aircraft with the runway and landed.

During the landing roll the Convair nose gear, damaged at impact, collapsed and the aircraft continued approximately 4,200 ft. on its nose and main gear before stopping on the runway on a heading of 280 degrees.

Stewardess Gunn opened emergency exits at seats 5, 9, and 17, located on the right side of the cabin, and opened the rear service door. Capt. Pollard released the forward passenger door but because the nose section of the aircraft was resting on the runway the exit could not be used until First Officer Myrick evacuated through the right cockpit window and pulled the

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SIZE 10
.937" diameter

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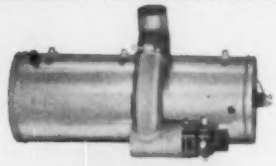

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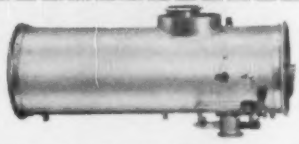

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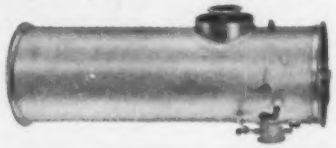

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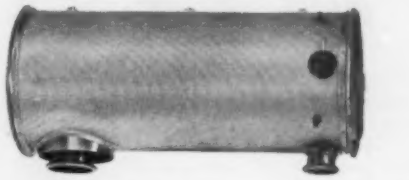

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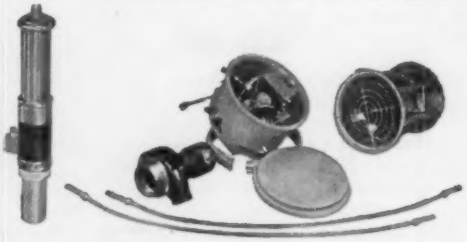

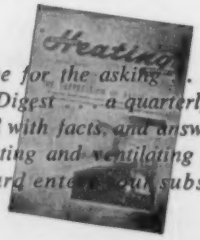

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the tower. A fourth man, a CAA terminal

exit stairway ramp outward from the aircraft, thus permitting this exit to be used for passenger exacuation. Stewardess Gunn pulled the emergency rope from its location above the rear service door and dropped it through the opening.

Evacuation was then carried out with 16 passengers using the emergency rope, two the seat exits and 13 the forward passenger door. The infant was dropped through the rear service door into the arms of a passenger on the ground. The evacuation was accomplished in an expeditious and orderly fashion with only minor injuries resulting to 10 passengers and the stewardess who received rope burns on their hands while sliding down the emergency rope. The emergency evacuation chute, located on the side of the rear service door, was not utilized.

Two small friction fires, one located in the nose wheel well and one in the forward baggage compartment, were quickly extinguished by ground emergency crews alerted by tower personnel before the aircraft had touched the runway and on the scene immediately.

The afternoon of the same day a Navy SNB, 23773, a Twin Beech, was dispatched from the Port Columbus Naval Air Station in accordance with Naval training procedures to be flown to Vandalia, Ohio, West Lafayette, Ind., and return. The flight departed at 1701 under a VFR (visual flight rules) flight plan and arrived at Vandalia at 1727 where one passenger was discharged. The flight continued to West Lafayette where it landed after an uneventful flight. LCdr. J. Reno, the pilot for this segment, left the flight.

With LCdr. J. R. Hoerath as pilot, and LCdr. D. Edgar as observer, Navy 23772 departed West Lafayette at 1902 for the return flight. The flight averaged about 150 knots groundspeed and at approximately 2009, when over downtown Columbus, it called the tower for landing information using frequency 142.75 mc. The tower advised the flight to use Runway 27. Shortly thereafter the SNB requested and was granted permission to use Runway 30 subject to traffic. Navy 773 was observed by the tower controller to enter the downwind leg of a left traffic pattern for Runway 30 and was later sighted on base leg for that runway about 2 miles southeast of the tower. The SNB was then advised by the tower controller to follow TWA Flight 377 on Runway 27 or make one circle of the field. The SNB turned right, reported it was on downwind for Runway 27. It later reported on base leg for that runway and was then advised to continue its approach.

The SNB and Convair were soon thereafter seen about 2 miles east of the airport on final approach to Runway 27, at which time they appeared to the controller to be close to each other but with the SNB apparently to the right, to the rear and below the Convair. The SNB was instructed to make a 360 or circle the airport. The landing gear of the SNB was seen to retract and it appeared to make a shallow left turn just before the collision.

INVESTIGATION

The investigation and subsequent hearing revealed that at the time of the accident there were three controllers on duty in

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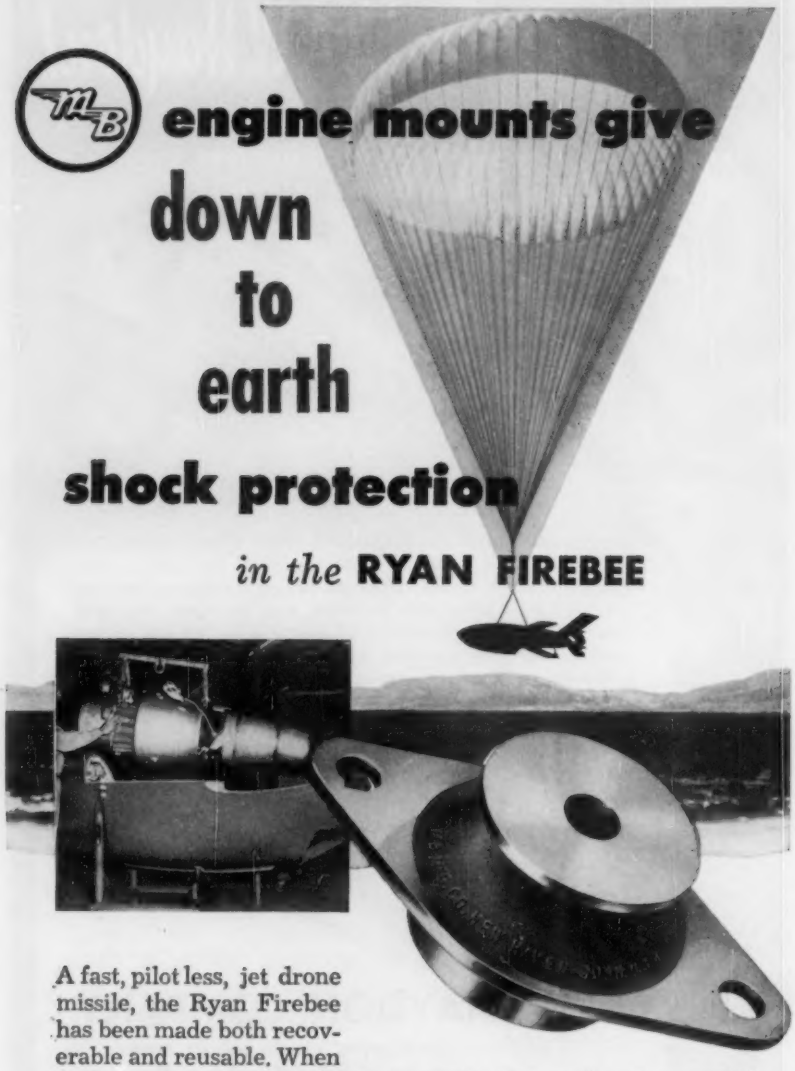

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the tower. A fourth man, a CAA terminal area operations specialist from the New York regional office, was in the tower for the purpose of leaving his local contact point but had no control duties. The regular controllers reported at 1600 for a normal 8-hour shift.

Local control, flight data, and ground control were manned as primary positions and under routine procedure they were rotated about every two hours. The local controller had assumed that position approximately 45 minutes before the accident.

Under procedures for the control of air traffic the local controller is responsible, among other things, for the issuance of clearances and information to pilots of aircraft for the purpose of preventing collision between aircraft in the traffic pattern.[2]

The Port Columbus Airport served the flying operations of the Naval Air Station located on the field, commercial operations, and North American Aviation production test flights, as well as transient and private flying. The tower personnel were therefore required to control many types of aircraft and regularly approved several types of traffic patterns such as overhead, left, right, and straight-in as permitted by Civil Air Regulations.[3] The personnel on duty were well qualified and thoroughly experienced in this situation. During the critical accident period the tower local controller was busy with ground and air traffic; during the period he made 28 transmissions and received about 43 replies from aircraft, all within 8 minutes before the collision.

The tower was located in the southeast corner of the airport and the runways were as shown in sketch, page 70. Several qualified witnesses stated that the tower was considered marginally adequate. They stated it was originally constructed as a weather observation tower and was not as high as desirable.

The windows consisted of approximately 140 small panes of glass with divisions between each. There were eight one-foot wide concrete support columns equally spaced around the octagon-shaped structure and one large solid entrance door in the south wall. A radar installation covered with a canvas tent had been added to the tower several months before the accident. These conditions required the local controller, whose position faced north, to stand and move continuously while observing airport traffic. At the time of the accident a new tower was being constructed.

Investigation revealed that transmissions to the American flight were conducted on 121.1 mc. and to the Navy flight on 142.74 mc., both VHF (very high frequency). Jet traffic taxiing used 257.8 mc., UHF (ultra high frequency). The local controller transmitted simultaneously on these frequencies thereby enabling the subject crews to hear all transmissions from the tower.

The American and SNB crews, however, transmitted on different frequencies to the tower and were thus unable to hear one another. This communications arrangement required the local controller to advise taxiing aircraft using UHF because

[2]See ANC Manual, "Procedures for the Control of Air Traffic," Part 3.0.
[3]See Civil Air Regulations 60.18.

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the ground controller, usually performing this duty, did not have the necessary UHF transmitter available at his position.

A recording device was incorporated at the local control position so that all transmissions he made were recorded. The recording was one way, from tower to aircraft.

During the public hearing the tower local controller stated that after having approved the Navy request to use Runway 30 for landing, subject to traffic, he first sighted that aircraft when it reported entering downwind leg for Runway 30. The controller observed the aircraft flying southeast about 1,500 ft., above the ground approximately 2 miles south of the tower, a normal downwind position.

The controller answered the report as follows: "Seven Seven Three, continue approach for Runway Three Zero. Traffic is on final approach and also on right-hand downwind for Runway Two Seven. I'll get you in on Three Zero as soon as practical." This transmission was then acknowledged.

At this time the controller stated that American 572 was northwest of the airport entering right-hand downwind for Runway 27 and that TWA Flight 377 was about 5 miles due east making a straight-in approach for Runway 27 for which it had been previously cleared. This flight followed a DC-3, 12F, then well ahead on final approach for the same runway.

The American Convair crew testified that they were entering downwind or had turned onto downwind when TWA reported over the outer marker (6.2 miles east of the threshold of Runway 27). The American crew sighted TWA immediately thereafter just inside the outer marker.

The next pertinent transmission from the tower was to American when the flight was on its downwind leg for its right-hand approach pattern. The tower instructed the flight as follows: "Five Seventy-Two will be number two to land on Runway 27, traffic is a TWA Martin about three out . . ."

The Navy flight then reported that it was on base leg for Runway 30 and the controller testified that this call, to his best recollection, included a report that the aircraft landing gear was down. He stated that at this time he saw the aircraft flying northeast about 2 miles southeast of the tower, a normal base leg for Runway 30.

This Navy report was answered by the controller as follows: "Navy Seven Seven Three, I have you in sight. I suggest that you follow the TWA Martin or make one circle of the field. I have traffic taxiing on Runway 30 and two on downwind for that runway." The controller testified that he meant on downwind for Runway 27. The Navy flight acknowledged his transmission advising it was on downwind for Runway 27.

The controller continued, "Continue your approach for Runway 27, Seven Seven Three." In explanation of these instructions the controller said it was no longer feasible to continue the SNB to Runway 30 because that runway and Runway 27 intersect and spacing of these aircraft was insufficient to enable either to clear the intersection before the other landed as required by controlling procedures. He also said there seemed to be adequate

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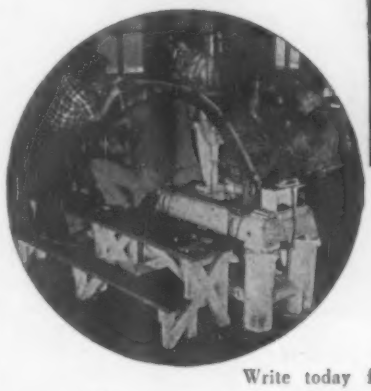

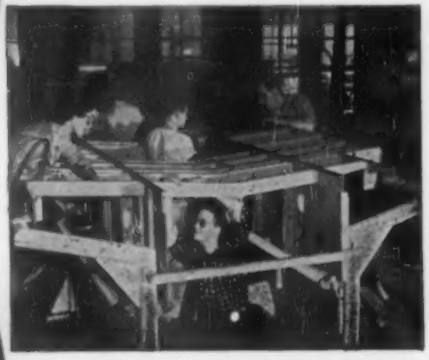

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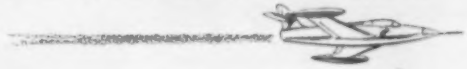

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spacing for the Navy flight to land after the TWA aircraft before American 572 because 572 was still eastbound north of the tower on its right pattern downwind leg.

The controller stated he expected and planned for the SNB to follow TWA from its observed position rather than turn right and establish a downwind leg for Runway 27. He observed the SNB, about 800 ft. above the ground, turn right about 30 degrees for the downwind leg. The controller did not advise the American flight of his instructions given the SNB to follow TWA because he stated it was then necessary to turn, view the TWA flight about 1½ miles east of the threshold, and clear it to land.

The SNB flight then reported that it was on base leg for Runway 27. The controller was unable to locate it visually although other tower personnel helped at his request. He advised the aircraft to continue its approach. The controller stated that at this time he was unable to revise the existing sequence because the SNB was not in sight.

Shortly after the SNB's base leg report the Convair was observed to make a right turn to the south for its base leg. At this time the controller stated he did not offer advisory information or instructions to either aircraft although he knew, by radio report, the SNB was on base leg and the Convair, by visual observation, was on base leg. He stated that he did not revise the existing sequence at this time, again because the Navy aircraft was not in sight and he felt that by altering either aircraft's position with instructions might create a hazard. At this time the controller did not ask the SNB for its position or ask the Convair if it had the SNB in sight but instead issued taxi instructions to aircraft on the airport.

The controller next observed the SNB on a final approach about 250 ft. above the ground, and approximately 2 miles east of Runway 27. At the same time it appeared to him to be below, to the right, and behind the Convair. He made the following transmission, "Navy Seven Seven Three, I have two aircraft on the final approach, one is American Convair high and you appear to be slightly behind and to the right, is that correct?" The witness stated the Navy crew transmitted, "Roger (or affirmative) I have him in sight, shall I go around?"

The controller then said, "Navy Seven Seven Three, affirmative, make a 360 or make a circle of the field and follow the American Convair." The controller stated the SNB appeared to be sufficiently behind the Convair that collision did not seem imminent. He then cleared the American flight to land and saw the SNB's landing gear retract. The witness believed 20 to 25 seconds passed between the circling instruction and the aircraft collision which followed.

The investigation included an exhaustive search for eyewitnesses to the accident. Many saw both aircraft during final approach and saw them collide. The witnesses observed the accident from four locations. Two boys, composing the first group, were located about 2 miles east of the runway threshold. They saw both aircraft during the last portion of their turns onto the final approach. They stated the Navy plane was ahead of and lower than the airliner.

Those of the second group were at positions varying between ¾ and 1¼ miles directly east of the runway threshold. Several of this group saw the aircraft pass nearly overhead on the final approach and at that time stated the SNB was below the Convair and slightly to its right. These witnesses were in conflict as to which aircraft was ahead; however, the majority stated the SNB was ahead.

The third group was located near the east end of Runway 27. This group was mainly composed of air crews who were in aircraft waiting to taxi or take off and who saw the aircraft which collided coming nearly directly toward them. When these two aircraft were first seen these observers stated that the Convair was 200 to 300 ft. above the SNB and that the SNB appeared to be to the right and behind. Several of these witnesses saw the landing gear of both aircraft extended. They then saw the SNB gear retract, the aircraft climb slightly, begin a left turn, with the collision following immediately thereafter.

The last group of witnesses was located in or near the tower. They were in accord that when first sighted the Navy aircraft was lower than normal for its position approximately 2 miles east of the runway on approach, and was 300 to 400 ft. below the Convair. The SNB flew nearly straight and level while the Convair descended normally. These persons stated that the SNB appeared well behind and slightly

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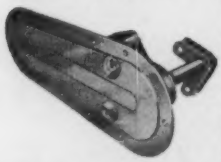

No. 676 Auxiliary Deadlock
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to the right of the American flight.

Several witnesses from all positions observed that the Convair's position and anti-collision (a red flashing light located on top of the vertical stabilizer) lights were on; however, none noticed whether or not the SNB's position lights were on.

In the course of investigation three incandescent position lamps were recovered from the SNB, one from the fuselage position and two from the tail light unit. These lamps were sent to the National Bureau of Standards to determine if the lights were on or off at the time of the collision. All filaments were broken when examined. The fuselage lamp, a 2-filament type, indicated that at least one of the filaments failed with voltage applied to it. However, it could not be determined whether failure occurred during the accident or at some other time prior to the accident. The other filament and the filaments from the tail lamps presented no conclusive evidence regarding whether or not these lights were on or off at the time of failure. As a result it could not be determined from the laboratory examination whether or not the SNB lights were on or off at the time of the inflight collision.

The TWA crew stated that at the time the SNB was instructed to make a three sixty or go around they had just landed and saw the collision immediately after clearing the runway.

The American crew stated that while in the Port Columbus traffic pattern they were aware that an SNB was being controlled as airport traffic. They believed it was going to land on Runway 30 and did not know it had been changed to Runway 27. The crew testified that they were fully cognizant of their visual responsibilities under VFR conditions.[4] Although they stated that they maintained a careful lookout the SNB was never seen.

The official weather report at the time of the accident was: scattered clouds at 20,000 ft., visibility 15 miles, wind north at 6 mph. Official sunset was 2005, 10 minutes before the accident.

The accident occurred during twilight when the sun was below the horizon and a rapid transition was taking place between daylight and darkness. Witnesses varied in their estimates of the existing visibility from three to 15 miles. All pilots who were flying at this time agreed that vertical visibility was decreasing with approaching darkness and that it was becoming increasingly difficult to see objects from above. The existing light above the horizon permitted aircraft flying above it to be easily seen in all directions but somewhat easier in the western quadrant.

The most significant of the many inflight impact markings was a series of six propeller cuts in the left wing of the SNB. The structural integrity of the wing was so affected by the cuts to cause the left wing outer panel to separate in flight. This portion of the wing was found east of the main wreckage area. The cuts progressed forward from the left wing trailing edge across the left engine nacelle centerline. Study of the individual cuts disclosed that in each case the cut was made inboard to outboard with downward directional indications at the start of the cuts and upward directional indications at the outboard end. Further study revealed the cuts were made by the left Convair propeller while it was passing forward over the wing. The pattern of the propeller damage indicated that the aircraft closed both laterally and vertically; both closures were at small acute angles.

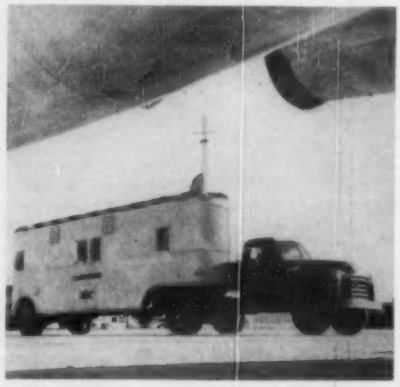
The Convair nose gear drag link was fractured by forces mainly in a rearward direction. Although not conclusive, evidence indicated the nose gear tire struck the SNB in the area of the right wing center section and right wing center section and right nacelle. Gash marks and impressions on the sidewall and rim of the left Convair nose wheel appeared to have been inflicted by a glancing blow of the SNB right propeller, a tip of which was found east of the wreckage area.

Although the SNB reported no difficulty, careful examination was made to ascertain if any structural or mechanical failure occurred prior to the collision. From the damaged components there was no evidence found to indicate that structural or mechanical failure occurred prior to impact. The American crew substantiated that the Convair was operating normally prior to impact.

The investigation included a careful study of the flight paths and position reports of the four principal aircraft which were flying in the Port Columbus traffic pattern during the accident period. These factors together with witness testimony were incorporated into an engineering study (p. 70), and indicate the probable flight paths of the aircraft which collided, as well as the TWA Martin and the Douglas DC-3 which preceded them.

Considering all available data and the probable flight paths a study was made to determine so far as possible the visual limits of each crew member afforded by the cockpit structure of the Convair and SNB. The limits were applied to each crew member throughout the last two minutes of the flight path in consideration of the aircraft attitudes.

It was learned that the SNB first entered the cockpit angular limits of vision



Trailer for Telemetry

Transportable telemetry station, mounted in this trailer enables A. V. Roe, Canada, Ltd., engineers to keep tab on 67 different bits of information being measured in aircraft under flight test. FM/FM telemetering system is used.

[4]See Civil Air Regulations, Part 60, Sections 60.12, 60.14, 60.15.

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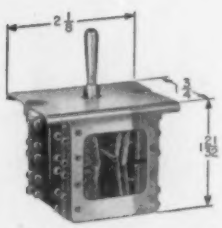

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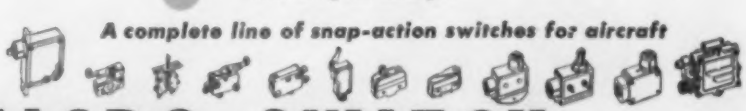

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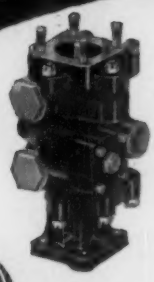

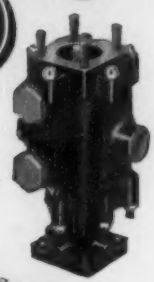

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for the Convair captain when the Convair was on the base leg. At this time the SNB was approximately 40 degrees to the right of the Convair's longitudinal axis and was about 3 miles away. The SNB remained within the visual limits of the captain's position until both aircraft were on the final approach and the Convair was approximately ¼ mile behind the Navy aircraft. The total time that the SNB was in the visual limits of the captain's position was approximately 1¼ minutes. At the start of this period the SNB blended into the horizon and then continued below it for the remaining time.

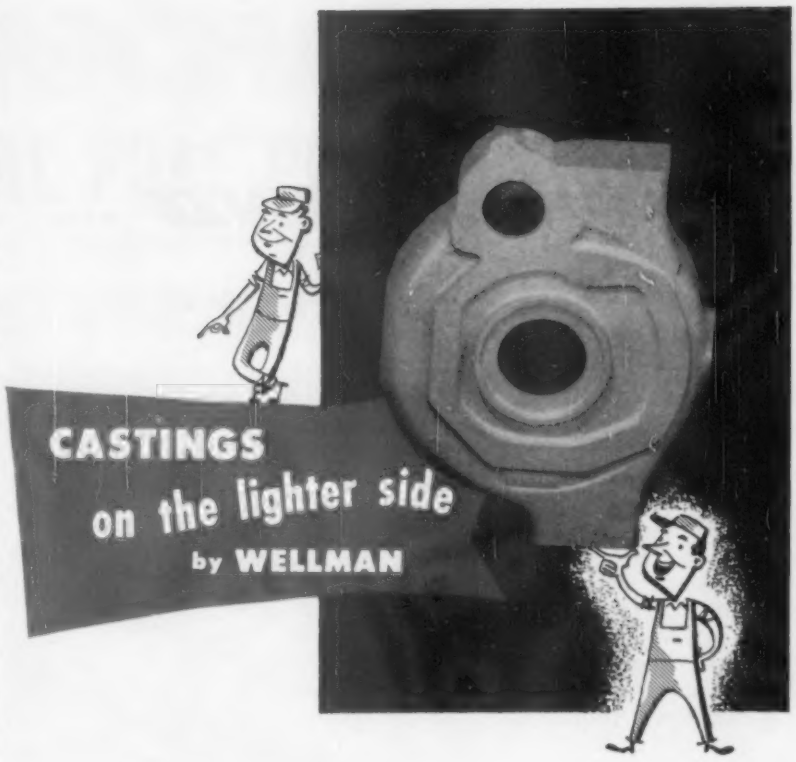
The SNB first entered the visual limits afforded from the seat of the Convair first officer shortly after he had begun the turn from the downwind leg onto the base leg.

When the turn was begun the SNB was approximately 90 degrees to the right of the Convair's longitudinal axis and was about 3¾ miles away. The SNB remained within visual limits of the first officer's position except when momentarily obstructed by two vertical windshield formers until the Convair was approximately ¼ mile behind the SNB on the final approach. The total time during which the SNB was within the visual limits was about 1¼ minutes. At the beginning of this period the SNB blended with the horizon and then continued below it for the remaining time.

The Convair first entered the visual limits afforded by the SNB's cockpit structure from the pilot's position immediately after the SNB started to turn from the downwind leg onto the base leg for Runway 27. At this time the Convair was approximately 3 miles away at an angle of approximately 20 degrees to the left of the SNB's longitudinal axis. The Convair remained within the pilot's visual limits above the horizon approximately 15 seconds except when momentarily obstructed by a windshield former. At the end of this time the Convair was about 30 degrees to the right and was approximately 2 miles away and the SNB had progressed to and was on the base leg.

The Convair first entered the visual limits afforded from the observer's seat immediately prior to the start of the turn onto the base leg. At this time the Convair was approximately 70 degrees to the left and was about 3¾ miles away. The Convair remained above the horizon from this position and was within the visual limits of the observer approximately ¼ minute except when obstructed by two windshield formers and upper cockpit structure for about 15 seconds. At the end of this time the Convair was approximately 30 degrees to the right and was about 2 miles away. The SNB was then on the base leg at which time the opportunity to see the Convair terminated as the Convair was obscured by the SNB cockpit structure and was behind the crew's visual limits. The 15-second period during which the Convair was within the cockpit visual limits occurred nearly simultaneously for both crew members.

Three days after the accident, at approximately the same time of day as the accident, several preplanned flight tests were conducted. These tests were made using an R5D (DC-4) and an SNB flying in general proximity, with the SNB varying its position, according to prearrangement, relative to the R5D. The R5D is some-



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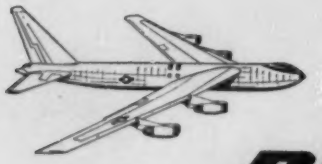

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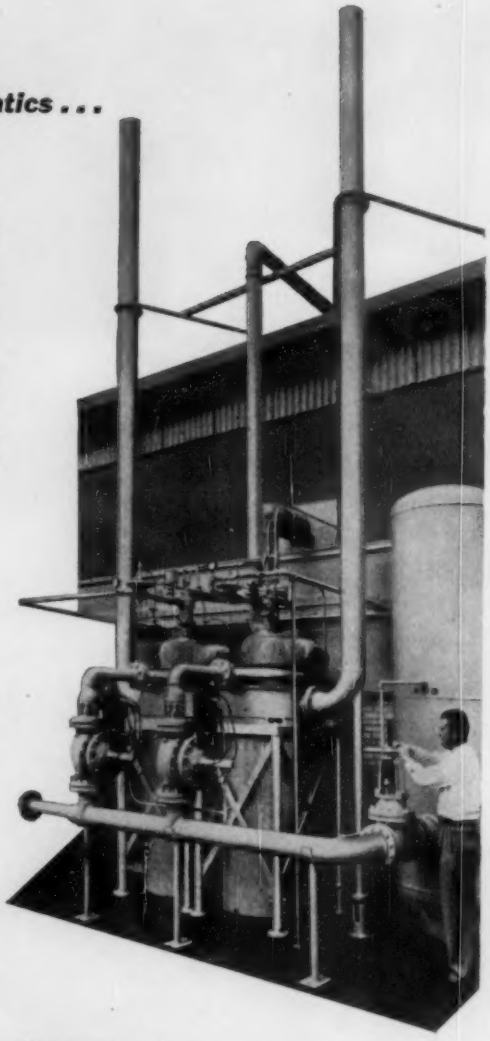

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what larger than the Convair 240.

Qualified ground observers positioned in the tower and on the airport watched, noting their impressions of the aircraft positions relative to one another while they were on the final approach. Although the SNB changed its position, including being ahead of the R5D, the observers concurred that the difference in sizes of the aircraft gave the illusion that the smaller was always behind. As the aircraft flew closer toward the runway the smaller aircraft appeared to also overtake the larger.

ANALYSIS

It should be recognized that the engineering study of all the available evidence, "The Probable Flight Paths," contains certain variables. These variables which include altitudes, distances and airspeeds were carefully considered and the flight paths as shown are the most accurate commensurate with the physical evidence and testimony.

In determining whether or not the crews of the two aircraft should have observed the other, several other factors must be considered. The first is the angular limits of cockpit vision. This factor is the opportunity to see an object afforded by the physical cockpit structure only. A second factor is visual range. This is the maximum distance at which an object can be seen. This distance is influenced by variable factors including contrast of the object and background, its angular size and shape, the degree of lighting and atmospheric visibility.

Finally, the physiological factors affecting the ability of a human being to see an object must be considered. It can be expected a person may best see an object when it is within the angular limits of his sensitive or focal field of vision, 1 to 2 degrees wide. An object will also be seen through the peripheral portion of the eye if there is sufficient movement or contrast, otherwise it is necessary to search for the object.

As shown by investigation the SNB crew's opportunity to observe the Convair existed while the SNB was turning from the downwind leg onto the base leg and for a portion of the base leg. This opportunity existed nearly simultaneously for the crew members and lasted approximately 15 seconds during which the Convair was high on the windshield for both the pilot and the observer. During this time, however, had the SNB crew looked in the direction of the Convair, then on the base leg, they should have seen both the Convair's anti-collision light and the aircraft itself which were clearly visible above the horizon under the existing light conditions. During the last part of base leg the opportunity to see the Convair terminated and it was not possible again to see it.

From only the standpoint of cockpit angular limits of vision the Convair crew was first in position to see the Navy aircraft when the Convair was turning onto the base leg. In respect to the captain, the SNB remained within visual limits from this time until the Convair was on final approach and was approximately ½ mile behind the SNB. The Navy aircraft remained within the visual limits of the first officer's position throughout this period and until the Convair was approximately ½ mile behind the SNB on the final approach.

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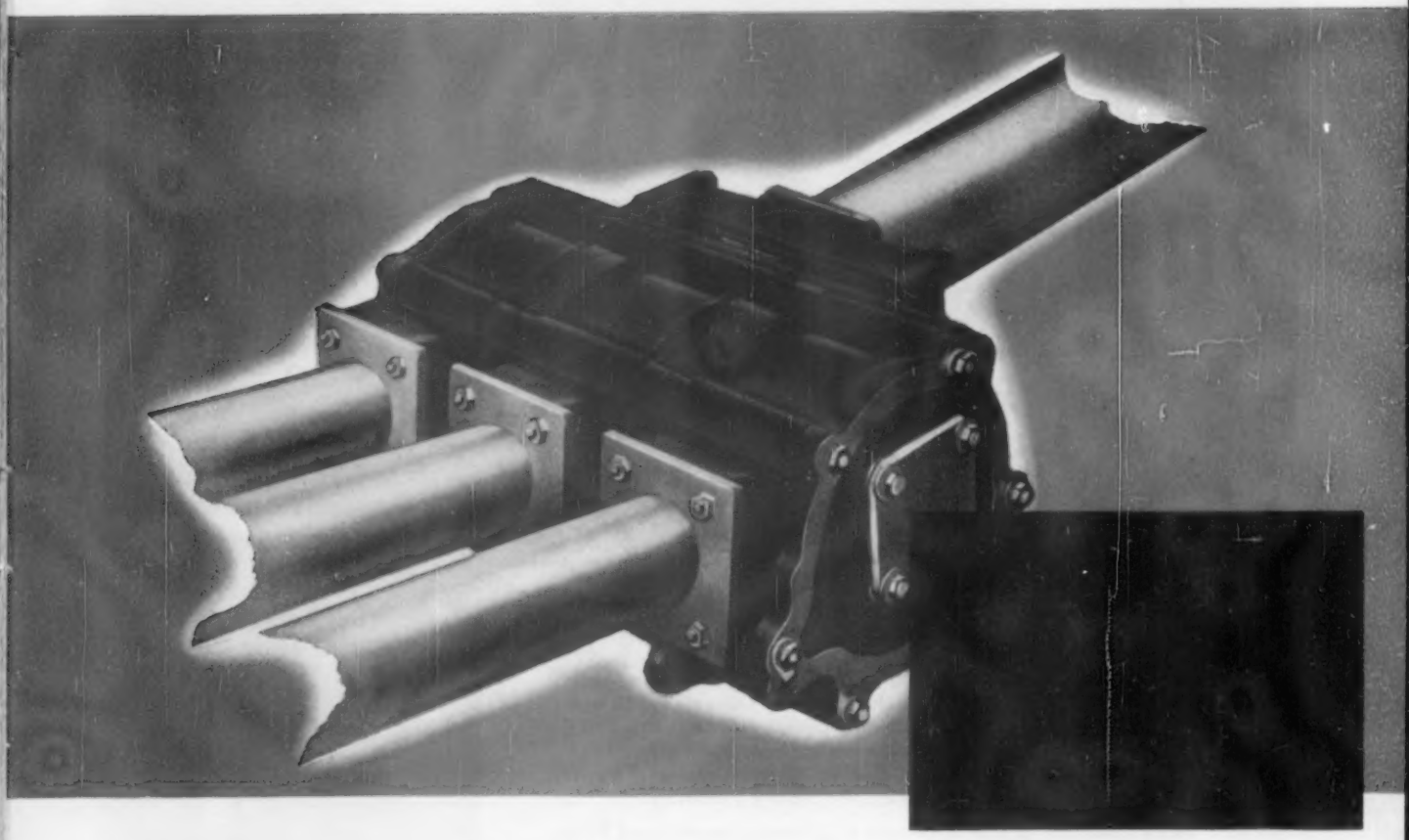

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leg and then onto the final approach it descended until it was approximately 250 ft. above the ground and when first seen by witnesses, on final approach, it was estimated to be as low as 200 ft.

While the American flight was on its base leg, considering the factors affecting visual range (threshold visibility factor, the dark terrestrial background, the fading light condition, the size and the view presented by the SNB), it is considered improbable that the SNB, which was below the horizon could have been seen from above by the Convair crew.

When on the final approach had the Convair crew scanned ahead within the cockpit visual limits, the target presented by the SNB was within their focal field of vision. Although during the first part of the Convair

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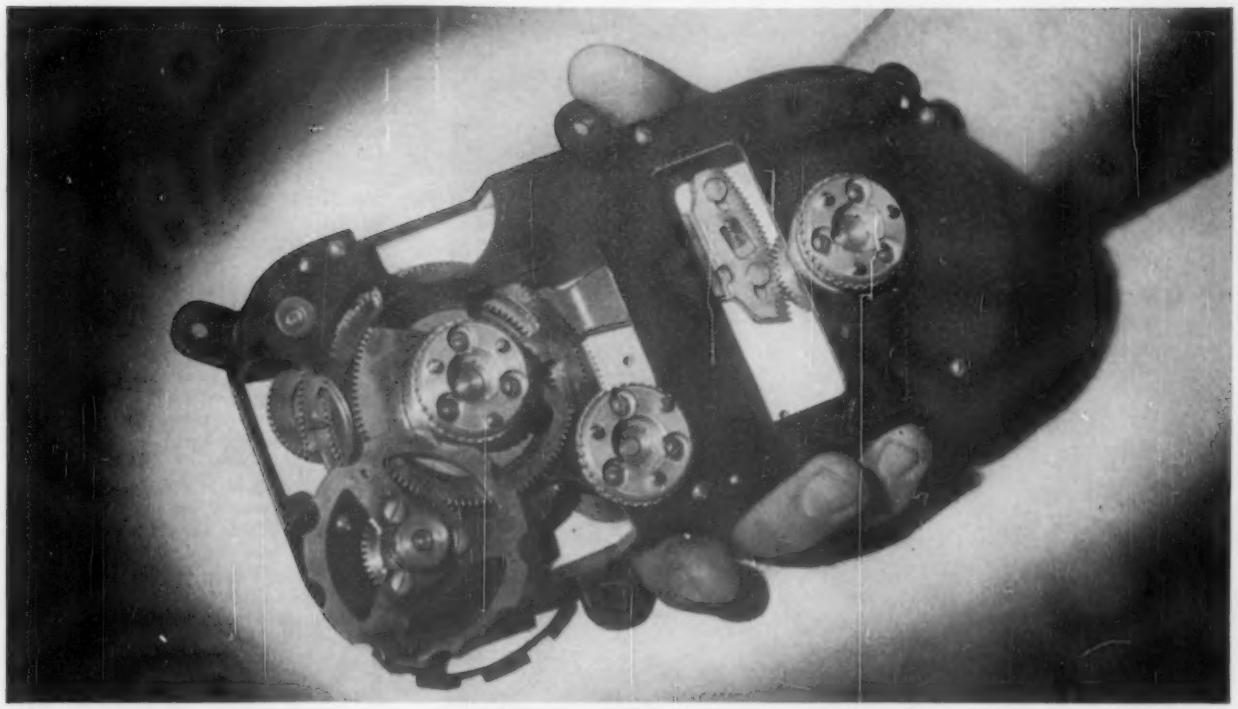

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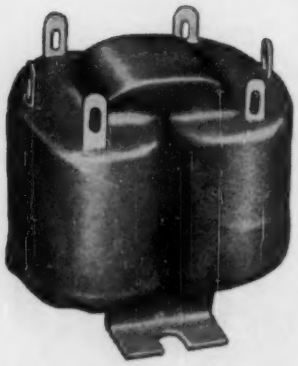

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final approach the SNB was low, against a poor background, and with little relative motion or contrast to attract the attention of the Convair crew, it was also within visual range and could have been seen by the Convair crew under the existing conditions.

During the period when the flights which collided were being flown in the Port Columbus traffic pattern all transmissions made from the tower to them were "simulcast" (transmitted simultaneously on all frequencies then in use). This arrangement enabled the crews of both aircraft to hear all transmissions from the tower.

Although many extraneous transmissions were made and only the transmissions from the tower could be heard, it is difficult to understand why the conflicting approach sequence, both to approach behind TWA Flight 377, was not heard by either crew. The conflicting approach clearances were pertinent to each flight and directly affected their traffic sequences. Had both crews maintained radio vigilance the conflicting instructions could have been detected and an immediate clarification requested. It is also difficult to understand why the American crew did not request from the tower the position of the SNB when they were searching for that aircraft and were unable to locate it.

It will be recalled that when the SNB reported on the base leg for Runway 30, the tower controller observed the flight approximately 2 miles southeast of the tower. The controller, realizing that he could no longer continue the Navy approach to Runway 30, advised it to follow the TWA flight on Runway 27 or circle the field. This traffic control clearance was given without advising American of it or altering its sequence which was also number 2 to land after the TWA flight. The controller knew that the SNB was going to continue to Runway 27 and not circle. This situation continued to exist unaltered until both aircraft were seen on final approach. Both aircraft were advised to take the same sequence from opposite sides of the traffic pattern onto a common approach path to the same runway.

The controller stated that the SNB did not follow his instructions as he had planned. Instead of following TWA 377 from its observed position it turned right, established a downwind leg for Runway 27. In planning its spacing behind TWA, it is believed the SNB crew necessarily took the action it did to establish a correct interval. The spacing which existed behind TWA on final approach was normal. If the SNB's action were not in accord with the controller's planning there was sufficient opportunity to issue other instructions to the SNB and to clarify the sequence between it and American 572. A nonconflicting sequence should either have been given initially or the conflicting sequence revised immediately after the controller turned, viewed the TWA flight and cleared it to land.

The SNB then reported that it was on base leg for Runway 27 but the tower personnel were unable to see it. At this time the controller advised it to continue its approach without asking its position or advising it that was not in sight. No advisory information was given when the Convair was seen shortly thereafter to turn onto its base leg although the controller knew the

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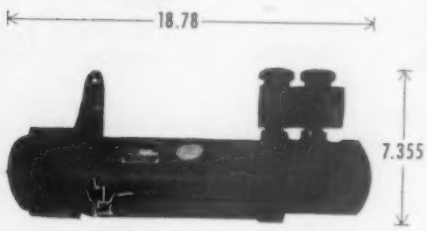

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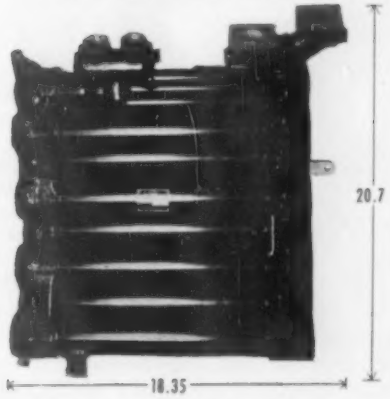

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situation continued to exist unaltered until

12. The Convair crew should have seen

Convair was being flown into an area where another aircraft was known, by radio report, to be operating.

The controller stated he could not give instructions because the SNB was not in sight and any instructions might result in conflict between the two aircraft. The Board believes that advisory information should have been given alerting the crews to the situation. The Board also believes that when simultaneous left and right traffic patterns are being used the controller should assume greater responsibility for effecting traffic separation.

When both aircraft were sighted on the final approach the controller thought that the SNB was behind, to the right, and below the Convair. Considering reasonable speeds for the two aircraft, the physical evidence presented by the Convair propeller cuts in the SNB wing and testimony of some eyewitnesses positioned nearly below the aircraft, the Convair was then above and behind the SNB.

The controller's error in judgment of relative distance was a normal reaction shared by the other tower controllers, pilots who were awaiting takeoff or taxi clearances, and confirmed by the experimental flight tests made after the accident under similar conditions. The error was caused by the difference in size of the aircraft when viewed at a considerable distance from nearly head-on angles under the fading daylight conditions. It is reasonable to assume that had the controller known the true positions of the aircraft he would have given other instructions which might have prevented the collision.

When the controller advised the SNB of its apparent position relative to the American flight the Navy flight reported that it had "him" in sight. Although the controller's information was clear, under the circumstances, it is believed the SNB crew misinterpreted it and responded with reference to the TWA Martin which, according to its crew, was just landing or on its landing roll when the information was given. In all probability the SNB crew mistakenly identified the Martin as the Convair; both are twin-engined aircraft and look very much alike.

FINDINGS

On the basis of all available evidence the Board finds that:

1. American Airlines, its crew, and its aircraft were properly certificated and the flight was properly dispatched.

2. The Navy aircraft was properly dispatched in accordance with Naval procedures and its crew was qualified for the subject flight.

3. Both aircraft were properly maintained and there was no evidence of structural failure or malfunction prior to the collision.

4. The control tower was properly manned with certificated controllers.

5. The accident occurred in good weather, 10 minutes after official sunset.

6. When the accident occurred the SNB was making an approved left approach pattern to Runway 27 and the American flight was making an approved right approach pattern to Runway 27.

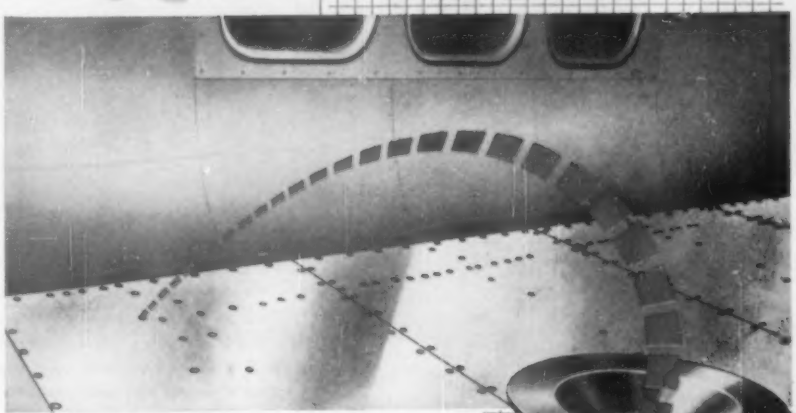
7. Both flights were advised to make their approaches following the same aircraft. This

2nd of a Series

...another

CRITICAL FASTENING PROBLEM

solved by Delron



problem: Lockheed engineers required a strong, lightweight bolt spacer for fast, economical installation of aluminum honeycomb structure in the famous Super Constellation. The floor construction illustrated is an example. Large quantity of fasteners to be used required low weight per unit, and had to be adaptable to mass production as well as manual installation.

solution: Delron's Fasco Spacers were tested by Lockheed and more than met requirements of this critical fastening job. On each Super Constellation, approximately 3500 Spacers are used, providing high column strength with a total weight of only 12 pounds. Fast 200 per hour mechanical sub-assembly installation as well as hand assembly, if required, are the reasons Fasco Spacers make ideal fasteners for honeycomb type structure.

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situation continued to exist unaltered until after both aircraft were on final approach.

8. The SNB was not observed by the tower after it established a downwind leg for Runway 27 until it was sighted on final approach for that runway.

9. No advisory information was given either aircraft with respect to the other's position until after the SNB was observed in close proximity to the Convair on its final approach.

10. The controller's incorrect clearances, which permitted both aircraft to follow the TWA flight, should have been detected by the flight crews.

11. The SNB crew should have seen the Convair under the existing conditions while turning onto and for the first portion of its base leg.

12. The Convair crew should have seen the SNB through normal vigilance during the first portion of its final approach.

PROBABLE CAUSE

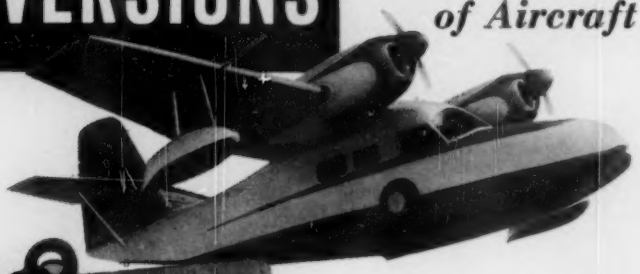
The Board determines that the probable cause of this accident was a traffic control situation created by the tower local controller which he allowed to continue without taking the necessary corrective action.

A contributing factor was the failure of both crews to detect this situation by visual and/or aural vigilance.

By the Civil Aeronautics Board:

/s/ Chan Gurney
/s/ Harmar D. Denny
/s/ Oswald Ryan
/s/ Josh Lee
/s/ Joseph P. Adams

CONVERSIONS *all types of Aircraft*



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Type of Aircraft owned_____

WHAT'S NEW

Telling the Market

Adhesives for Film, Foil, Fabric and Other Web Laminations is title of 12-page manual issued by Rubber & Asbestos Corp., Dept. P, 225 Belleville Ave., Bloomfield, N. J. Brochure shows typical laminations and gives properties of about 6,400 laminate-adhesive combinations. . . . **Leaded alloy steel,** claimed to be fastest for machining in its carbon range (.40 carbon) is described in Bulletin 14-5, available from Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80. . . . New 20-page catalog describes **extreme-tolerance gage block sets,** sine bars, tri-squares and accessory sets. Title is Gage Blocks and Special Gages. Write to Jansson Gage Co., 13550 Auburn, Detroit 39.

Standard Ferguson roller gear drives for **highspeed precision indexing of automatic production machinery,** plus data for calculating loads or designing installation, are described in 20-page Catalog 105 available from Ferguson Machine & Tool Co., Roller Gear Div., P. O. Box 191, St. Louis. . . . **How to Cut Die and Mold Finishing Time 50% to 94%** is title of 4-page bulletin No. 113 describing wet-blasting machines produced by American Wheelabrator & Equipment Corp., 1001 S. Byrkit St., Mishawaka, Ind. . . . Latest edition of 20-page Anchor Bushing Catalog, describing **laminated plastic Anchor Bushings,** is available from Hi-Shear Rivet Tool Co., 8924 Bellanca Ave., Los Angeles 45. . . . Prismo Safety Corp., Huntingdon, Pa., has published a booklet describing its Prismo process of **creating reflective runway marking materials.** The company is organized on a world-wide basis to handle complete marking projects on a contract basis.

Publications Received

• **Sailing Aerodynamics**—by John Morwood —Pub. by Philisophical Library, Inc., 15 East 40th St., New York 16, N. Y. $7.50. 124 pp. Theory of sailing in easily understandable form. The copy is accompanied by numerous illustrations and graphs.

• **Table of Sine and Cosine Integrals for Arguments from 10 to 100**—National Bureau of Standards Applied Mathematics Series 32. Order from Government Printing Office, Washington 25, D. C. $2.25; 186 pp. Reissue of the Table of Sine and Cosine Integrals for Arguments from 10 to 100, that was prepared by the Mathematical Tables Project of the Federal Works Agency, Works Projects Administration for the City of New York under the sponsorship of the National Bureau of Standards, published in 1942, and known as Mathematical Table 13.

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AVIATION WEEK

THE MAGAZINE OF AVIATION BUSINESS

ROBERT W. MARTIN, JR. PUBLISHER

A McGRAW-HILL PUBLICATION
330 WEST 42ND ST., NEW YORK 36, N.Y.

MEMORANDUM TO THE AVIATION INDUSTRY

On March 14, 1955, AVIATION WEEK will publish "Airpower in the Age of Peril," the 22nd Annual "Inventory of Airpower" Edition. In this annual number which has gained world-wide readership, AVIATION WEEK editors will report on the story of the Aviation Industry's transition from the Korean crisis buildup to the solid Industrial and Military Airpower base necessary to meet the growing requirements of the new U. S. Defense Policy. "Air Power in the Age of Peril" is of vital importance to all those Aviation Management Men, Engineers, Military and Government Officials whose efforts and interests are devoted to the expansion of civil and military aviation and the defense of our country.

Editorial assignments have been made to 17 AVIATION WEEK editors for special reports and articles. Traveling schedules are presently in force and a voluminous amount of material is now in the process of collection. In all, this outstanding issue will add to the record of usefulness of previous editions and establish new standards of factual presentation and reporting.

For advertisers, the 22nd Annual "Inventory of Airpower" Edition offers 1955's most appropriate spot for your sales message. I heartily recommend its use to all Aviation Manufacturing Companies and Suppliers as an outstanding 1955 editorial presentation.

Sincerely,

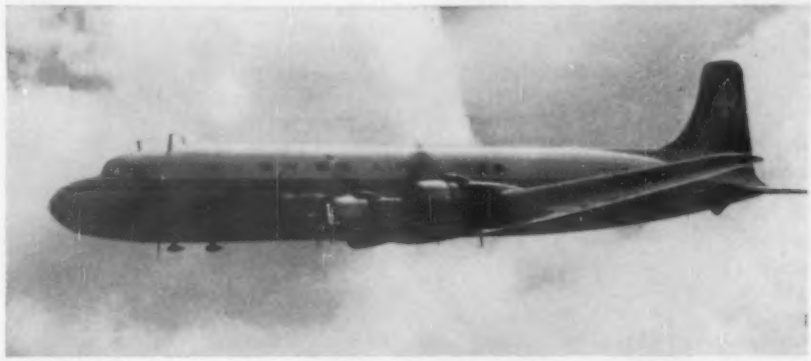
Robert W. Martin, Jr.

Robert W. Martin, Jr.

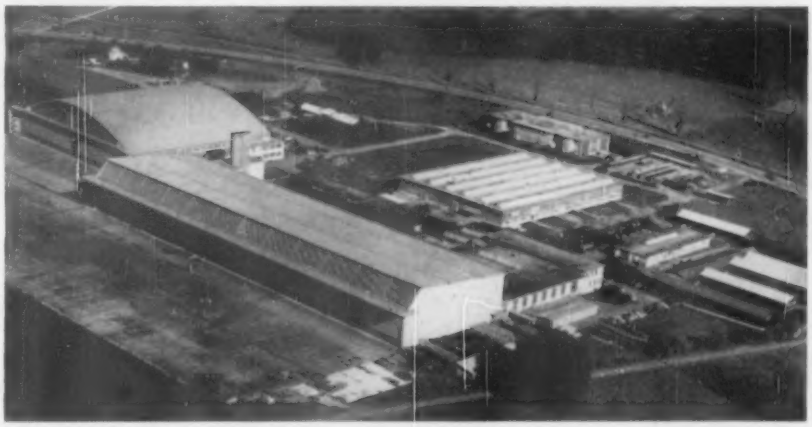
Swissair Bids for Bigger Atlantic Slice

- **Carrier to use DC-7Cs for trans-ocean routes.**
- **And it likes its 240s; 'no hurry on turboprops.'**

By William J. Coughlin



SWISSAIR DC-6B is one of six owned by airline. Two DC-7Cs will be received in 1956.



MAINTENANCE BASE at Kloten Airport, near Zurich. Engine shops are new installation.

Zurich—With two Douglas DC-7Cs on order for delivery at the end of 1956, Swiss Air Lines is preparing a serious challenge to its larger competitors for both first-class and tourist traffic on the trans-Atlantic routes.

Swissair considers the North Atlantic run the most important in its system, which also serves Europe and the Near East. To bolster its service on this route, the airline therefore decided to add higher performance equipment.

"We chose the 7C over the Super Constellation because we believe it definitely is a better airplane for our needs," says Heinz Haas, secretary general of the airline. "Also, because we already have an almost all-Douglas fleet."

▶ **Turboprop Interest**—Swissair operates six DC-6Bs, three DC-4s, 13 DC-3s and seven Convair 240s. The Swiss carrier's DC-7C order was placed before the presentation of Lockheed Aircraft Corp.'s L-1449 turboprop Super Constellation.

"We are interested in turboprop," says Haas, "but we are in no hurry." Swissair has little interest in the British Viscount, he adds, because the carrier's equipment is all of U. S. manufacture.

The airline's annual report states its position on new aircraft types this way:

"With regard to the procurement of jet or turboprop aircraft, the Board of Directors has not yet made a decision, as the question of economic operation of these types still remains unsettled. In any case, the more urgent problem of efficient utilization and amortization of our present fleet—deemed fully adequate for present needs—must come first. The position taken by Swissair on this question is identical with that of leading American carriers."

▶ **Likes Its Convairs**—Although the airline is studying the helicopter field with interest, Swissair feels it still is too early to purchase such equipment in view of the present state of development of the helicopter. Swiss topography will demand a highly efficient machine.

Swissair has contributed towards financing the Swiss Helicopter Co., however. This is a company devoted to the study of helicopter performance.

The carrier has found the Convair 240 nicely suited to its European routes. "We do not need the added range which the 340 would provide," says Haas.

▶ **Two-Class Flights**—Although Switzerland draws tourists in winter as well as summer, the airline still finds its international traffic too subject to seasonal peaks and hopes to build increased traffic among businessmen.

Swissair believes one way to do this is to promote the two-class system on its international flights.

"To judge from the first results of tourist-class flights in Europe, it would appear that the curtailment of standard service was too radical, in that almost everywhere first-class flights were eliminated," the airline says.

Not only businessmen, but also a considerable number of travelers who use air transportation for vacation purposes still prefer the comforts of first-class accommodations, the airline points out, adding:

"Consequently, a combination of first-class accommodations in the same airplane with high density, less luxurious tourist-class facilities has been initiated."

▶ **Aircoach Headaches**—These mixed flights have been very successful, the carrier reports.

At the outset of tourist service, Swissair listed the majority of its flights as high-density tourist, with few first-class flights scheduled. Emphasis in the future will be more on mixed flights.

As the national carrier of a country which attracts large numbers of vacationers, Swissair has found that tourist traffic presents many headaches to a carrier.

"From the point of view of operations, certain difficulties are magnified," says the airline. "The passenger planning his trip with an eye toward deriving the most pleasure from his flight shows certain preferences with regard to the time he chooses to fly."

Flight schedules must therefore be adjusted to suit this demand, resulting not only in great variations in work

load throughout the year, but also requiring peak performance on certain days at certain hours while at other times work is quite slack.

▶ **Tourist Success**—"We are sparing no efforts in our attempts to distribute traffic more evenly throughout the day and night," a spokesman says.

In addition, tourist travel is more dependent than business travel on season, weather and other variable conditions.

"Whereas businessmen are obliged to arrange their trips to fit the business in hand, the vacationer is subject to no such restrictions and, consequently, is free to postpone his trip, employ other means of transportation or cancel his vacation plans entirely," says the airline.

"Poor weather, unfavorable business trends, or uncertain political conditions may cause him to drop his plans. The tourist, then, in this sense, is not to be regarded as an absolutely reliable customer."

Despite the difficulties, however, Swissair has found its tourist-class service a successful operation.

"What we need is not fewer tourists, but more businessmen," says one official of the airline.

▶ **Reducing Costs**—Home base for Swissair is the magnificent air terminal at Zurich, one of the world's finest airports. A new engine overhaul facility, now in operation at the Swissair maintenance center, is built to handle 300 engines a year. It has been constructed so that it can be enlarged on all sides.

Swissair has succeeded in reducing costs considerably by increasing the running time of engines and propellers as well as lengthening the interval between overhauls, all within an adequate safety margin. To stagger overhaul operations, the progressive maintenance system is used.

Swissair is prepared for a hard fight for expansion in the international field, but is confident of holding its place as a recognized trans-Atlantic carrier.

"Entering this field at a late date and as a small carrier, Swissair cannot expect to be welcomed with open arms in such highly competitive markets," the airline says. "Our outlook, nevertheless, is far from hopeless. Thanks to her central location, Switzerland has desirable transit rights to offer.

"Of these, she has always given generously and is, therefore, quite justified in demanding, now, appropriate reciprocity for Swissair. To an increasing extent Switzerland must consider air transport policy as trade policy. It is gratifying to note that Swiss public opinion stands firmly behind us in this matter, and with faith in the development of air transportation, we take an optimistic view of the future."

CAL-Pioneer Merger Foes Reopen Battle

Braniff Airways and Central Airlines have asked Civil Aeronautics Board to reconsider its action approving a Continental-Pioneer Air Lines merger (Aviation Week Dec. 13, 1954, p. 104).

Both protesting carriers say the Board is breaking down its historic policy of maintaining the separate integrity of trunk and local service operations.

▶ **Brush Off**—Braniff observes that CAB describes its decision as an exception to its policy, not a reversal. In its petition, Braniff says: "It is conceded that there may be exceptions to any policy. However, it must also be recognized that a policy can eventually be destroyed by the process of granting exceptions to it."

The airline also complains that the Board brushed off its exceptions to the examiners' report without sufficient consideration or answer, in violation of the Administrative Procedure Act. Among other things, Braniff questioned the service improvement that is supposed to result from the merger and raised the question of diversion from its own traffic when Continental begins to compete under new conditions.

"Continenal will not be satisfied to operate Pioneer's routes subject to the restrictions presently applicable thereto," the petition says. "Braniff knows, as the Board should, that inevitably Continental will seek to have these restrictions lifted and to have its routes consolidated with those of Pioneer so as to obtain the maximum flexibility of operation and to obtain access on a competitive basis to practically all important markets in the Southwest."

▶ **Transfer Problem**—Braniff also raises the legal question of whether Pioneer can transfer its present operating authority to Continental. PAL's certificate expired Sept. 30, 1954, but the local service airline had applied for renewal. Under the law, the feeder was authorized to continue to operate until the Board acted on the renewal application.

Braniff holds that the expired certificate continues in effect "only in the hands of the person who holds the certificate on its expiration date and only for the purpose of continued operation by that holder."

The Board also is asked to consider the extent to which the merger "will delay, if not completely eliminate, the possibility of eventual integration of Braniff and Continental."

▶ **Central Petition**—Central Airlines asks CAB to reconsider its action because:

- The proposal is not consistent with Board policy on separation of feeder and trunk lines, "which constitutes the cornerstone of the local service experiment in which Central is participating."
- No substantial improvement in economy or service will result.
- Pioneer no longer has an operating authority it can sell to Continental.

BEA Buys Herons

British European Airways has bought two de Havilland Heron Mk. 1 airplanes for service with its air ambulance unit in Scotland.

EAL-NWA Inaugurate Interchange to Miami

At Miami are the first planeload of passengers to arrive under an interchange agreement between Eastern Air Lines and Northwest Orient Airlines to provide through-service from Minneapolis-St. Paul. Northwest crews fly the Stratocruisers to Chicago, where EAL crews take them over. NWA crews pick the planes up again at Chicago on the return trip. Northwest Stratocruisers make the flight during the winter, Eastern's busy season; EAL Super Connies are used in the summer during NWA's busy time. Plans are underway to increase daily flight frequencies next spring and to add intermediate stops to the Minneapolis-St. Paul and Miami schedules.

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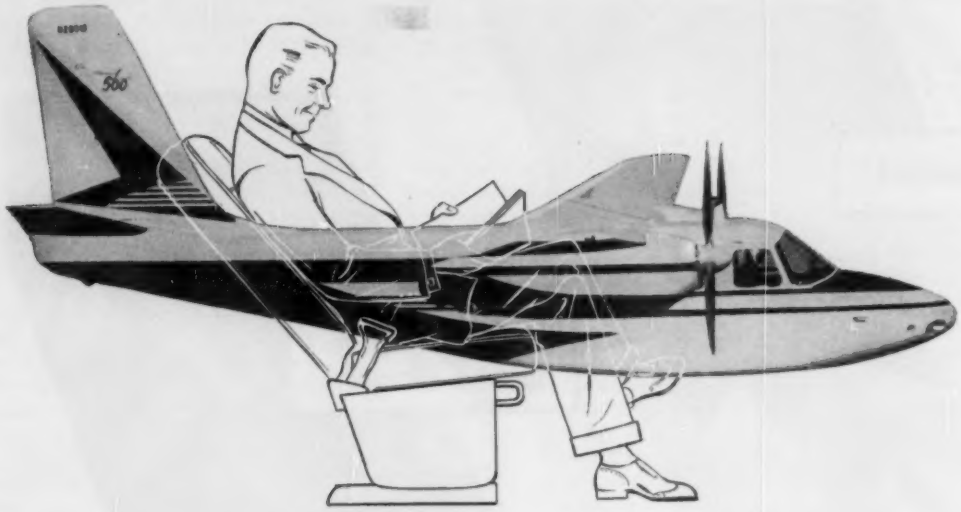

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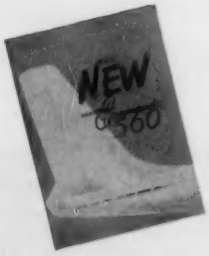

WRITE DEPT. 128 FOR NEW CATALOGUE

AERO DESIGN Commander 560

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98

Atlantic all-cargo service, but generally feeling is that granting a certificate to

North Central Airlines should have been considered before changing the

Certificate Fight

- **Mohawk claims it meets standards set by CAB.**
- **Board's dollar yardstick unrealistic, feeder says.**

Mohawk Airlines' vice president John R. Carver has submitted an analytical appraisal of the local service carrier's operating record to acting Civil Aeronautics Board chairman Chan Gurney. The move is designed to offset CAB's report last month on local service routes (AVIATION WEEK Jan. 3, p. 72) and to illustrate how Mohawk stands up against standards the Board has set down.

▶ **Subsidy, Service**—Carver says Mohawk met all 15 standards set by the Board and claims the CAB majority opposes permanent certification basically because subsidy bills have grown larger each year.

"A standard which looks only at total dollars and does not relate these dollars to the public interest is illogical," Carver says.

Carver believes CAB should consider subsidy in light of progress made and service offered in making its judgment.

An analysis of Mohawk's financial position indicates that the local service airline's subsidy bill may have reached its peak and started a downward trend.

Carver says figures for the 12 months ending Sept. 30, 1954, show subsidy need dropped from $887,691 to $771,251 and from 31.1 cents to 25.5 cents a mile. Subsidy need per passenger is down from $4.72 to $3.69 and from 2.7 cents to 2.0 cents per passenger-mile. Operating ratio is estimated at 1.21. Carver cites these figures as a 30% reduction in subsidy need during 1954.

Mohawk says this progress was made in 1954 despite the fact that New England service was operated all year, compared with only five months in 1953.

"It is clear that this outstanding progress, while providing more and more service to the public, should compel the majority to reverse its position against granting Mohawk at least a hearing on its application for a permanent certificate," says Carver.

▶ **Financing Problem**—Mohawk asked CAB last August to change the designation of its certificate from temporary to permanent. The current authorization expires June 30, 1958. Subsequently, the airline filed a request for expeditious hearing and early decision.

The difficulty in arranging long-term financing is cited by Carver as a prime drawback to temporary certificates, since Mohawk finds it impossible to arrange for money past the 1958 termination date.

Carver concludes that the Board should reconsider its stand on Mohawk's certificate since the carrier meets all the Board's tests, is reducing its subsidy need, is making reasonable progress toward self-sufficiency in relation to public convenience and necessity and shows a rate of increase of commercial revenues which exceeds that of costs.

BOAC Asks Okay on DC-7C Order

In a bitter blow to the home industry, British Overseas Airways Corp. has applied to the Ministry of Transport and Civil Aviation for permission to buy a fleet of 19 Douglas DC-7Cs.

The move climaxes a fight in Parliament over BOAC's overtures to buy additional aircraft in the U. S. market (Aviation Week Dec. 6, 1954, p. 15).

With the fate of de Havilland's Comet series "on the fence," the airline's top executives figured they had no choice. As one BOAC spokesman put it: "This is a highly competitive industry; we just have to have this equipment."

If the British government approves the application, it will mean an order totaling approximately $42 million for Douglas Aircraft Co. Competitively, it also would offset a $33-million order by Pan American World Airways for 15 of the same aircraft. PAA expects to begin taking delivery early next year.

Indications are that a BOAC order, coupled with Pan American's, would go a long way toward extending the life of propeller-driven aircraft for commercial operations. Both airlines are planning to use the Douglas DC-7Cs on their trans-Atlantic routes.

Avianca Claims '54 World Cargo Record

Avianca, Colombian airline, claims world leadership for the fifth consecutive year in air cargo traffic in terms of volume. Avianca also reports it hit new peaks in passenger carriage during 1954.

International and domestic flights in Colombia carried a total of 1.2 million passengers, an increase of 200,000 over 1953, and 226 million pounds of freight, a jump of 26 million. Domestic operations included transport of 1.3 million pounds of mail.

Avianca this year plans expansion of its freight operations in Colombia and an increase in international flights to New York and Europe. Equipment-wise, the company has purchased a new all-cargo aircraft for domestic service, while a fourth Lockheed Super Constellation is slated to go on international routes shortly. Company received its first three Super Connies in October. This gives Avianca a total fleet of about 70 aircraft.

The Pan American World Airways' affiliate operates eight flights a week between New York and Colombia, a weekly flight to Europe, and regular services to Panama, Venezuela and Ecuador. In Colombia, the airline connects 60 cities and operates a feeder-type air taxi service.

Douglas Says Feeder Airliner Still in Offing

Design studies with piston engines, turboprops and jets have failed so far to produce an economical new shorthaul transport, Carlos Wood, chief of preliminary design, Douglas Aircraft Co., Santa Monica, Calif., told the Society of Automotive Engineers last week.

He said Douglas is considering a turbine-powered helicopter as a possible answer to the problem.

Wood also reported that the company's DC-8 jet transport is expected to cruise nearly 200 mph. faster than the DC-7, yet develop lower operating cost than the DC-6/DC-7 series at all ranges above medium haul.

Airwork to Fly Atlantic In Leased U.S. Planes

Airwork Atlantic, recently certificated North American Division of Airwork, Ltd., will begin all-cargo service across the Atlantic Mar. 1 as scheduled, but not with its own aircraft. The British company has arranged to lease two transports—a DC-6A from Slick Airways and a DC-4 from Transocean Air Lines, according to reliable sources.

▶ **U.S. vs. British**—This is considered somewhat ironic in certain quarters. Airwork was granted a certificate for trans-Atlantic all-cargo carriage the middle of last year, while Seaboard & Western Airlines, U.S. applicant for the same certificate, still is waiting for a White House decision.

Seaboard backed its request with a fast, modern, high-capacity all-cargo fleet plus years of trans-Atlantic cargo experience. Airwork, on the other hand, backed its certificate application with Seaboard's economic figures and no airplanes.

There still is some question in government circles as to the need of trans-

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Atlantic all-cargo service, but generally feeling is that granting a certificate to a foreign airline which does not have any airplanes is hardly the answer to the question.

▶ **Anglo-German Route**—Meanwhile, while Seaboard waits, Airwork Atlantic's parent company has added another service to its European schedules. As of last week, the carrier was making weekly roundtrip cargo flights between London and Frankfurt.

Equipment for the new service consists of converted Vikings and C-46 Dakotas.

The company reports that this Anglo-German service will connect with other services at London Airport so that Frankfurt freight can be accepted for most designations.

Lee Calls Route Ruling Move to Kill Feeders

Strong objection to a Civil Aeronautics Board decision to turn local service Route 106 into a trunkline (AVIATION WEEK Jan. 3, p. 18) has been made by CAB member Josh Lee.

In a dissenting decision, Lee calls the majority action "merely another in a series of decisions which violates the Board's long-established policy of keeping the trunks and the feeders separate and moves closer toward the objective of abolishing the local service carriers as announced by the majority in the recent ACC policy study."

According to Lee, the majority has thrown away an opportunity to strengthen a local service carrier, Ozark Airlines, by chopping up one of the country's strongest feeder routes and giving it to United Air Lines and Braniff Airways, neither of which will provide service designed to develop shorthaul traffic.

Lee disagrees with the majority on six points:

- He opposes the finding that local Route 106 cannot provide adequate service to its points on the grounds that the route never has been operated by a local service airline but always has been run by a trunk carrier.
- He finds that, contrary to the Board opinion, the route has made progress toward reducing subsidy need. He believes it would continue to show substantial gain under a feeder that would concentrate on developing local business.
- He says the bulk of Route 106 traffic moves to and from Chicago, rather than Sioux City—a typical feeder characteristic. He claims the Chicago-Rockford bottleneck will not be broken by turning service over to trunklines, loath to give potential longhaul seats to local traffic.
- He believes applications of Ozark and North Central Airlines should have been considered before changing the route.
- He finds fault with arguments that United can provide better east-west service beyond Route 106 terminals, since this is true of any large airline and such policy would lead to decisions favoring the big carriers.
- He feels the majority has misjudged Ozark's expense and traffic development potentials on the route.

Lee favors awarding the route to Ozark and extending Braniff's Route 48 from Waterloo to Chicago.

Mackey Will Expand Nassau-Florida Route

Mackey Airlines now can offer expanded service between Nassau, British West Indies, and Florida under terms of a Civil Aeronautics Board decision.

CAB amended Mackey's certificate to include Tampa and St. Petersburg, Fla., on its route.

The Board also issued a temporary exemption allowing Mackey to start service immediately and take advantage of the heavy winter season traffic. The airline's foreign air transportation certificate will go into effect on Feb. 16, 1955.

Mackey has been serving Nassau from the co-terminals West Palm Beach/Palm Beach and Ft. Lauderdale. The new certificate establishes Tampa and St. Petersburg as co-terminal points and Ft. Lauderdale and West Palm Beach/Palm Beach as intermediate points.

CAB ORDERS

(Dec. 23-29)

ORDERED:

United Air Lines' proposed fare increases suspended until Mar. 31 and an investigation of them instituted.

Los Angeles Airways' final mail rates fixed as proposed by the Board, since no objection to them was filed during the allotted period.

GRANTED:

City of Detroit and the Detroit Board of commerce leave to intervene in a case involving Delta-C&S Air Lines' proposed service to Ft. Wayne, Ind.

AMENDED:

Spartan Air Services' authorization to conduct an airborne electromagnetic survey to terminate Jan. 31.

Investigation and suspension order concerning National Airlines' proposed bag-

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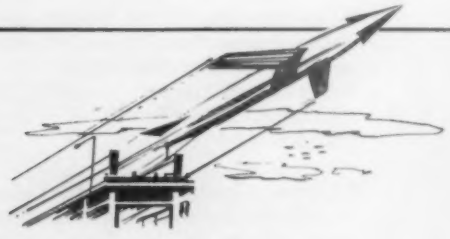

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gage claim rules to include additional material.

APPROVED:

Braniff Airways and United Air Lines' joint application to extend suspension of their Seattle-Houston interchange service until May 1.

Intercompany agreements involving Trans World Airlines, Delta-C&S Air Lines and various other carriers.

(Dec. 30 to Jan. 5)

APPROVED:

Agreements involving Trans-Texas Airways, Central Airlines and various other carriers.

Interlocking relationships between Slick Airways and Roy G. Woods.

DENIED:

Air Line Pilots Assn.'s petition for leave to intervene in the airfreight renewal case.

Eastern Air Lines' petition for reconsideration of a previous Board decision denying an Eastern motion for consolidation in the case involving amendment of Delta-C&S Air Lines' certificate for Route No. 54.

ORDERED:

Final mail rates be fixed for local service airlines for carrying preferential and other classes of mail, other than airmail and parcel post. Rate is fixed at 30 cents a ton-mile and is effective until Jan. 11, 1956.

Central Airlines' temporary mail rate fixed as proposed by the Board, since no objections were filed during the allotted period.

Braniff Airways, Pan American-Grace Airways and Pan American World Airways Latin divisions' mail rates be reopened as of Dec. 31, 1954.

GRANTED:

Allegheny Airlines a temporary exemption to require it to schedule only one roundtrip flight daily to Lock Haven, Pa., during the period of the year when daylight saving time is not in effect.

Two Alaska Airlines Win Mail Renewals

Ellis Air Lines and Alaska Coastal Airlines have won seven-year renewals of their mail transportation permits, and Ellis has been permanently certificated for its Ketchikan-Annette Island airfield route.

Both carriers operate between points in southeastern Alaska, carrying passengers, freight and mail.

The airlines had applied for permanent mail certification. But Civil Aeronautics Board found that since both Ellis and Coastal operate in a limited geographical area and have some service duplication, permanent certification is not warranted. The Board said that if the two carriers presented a merger plan, CAB might be persuaded to issue a permanent certificate for the area.

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SHORTLINES

► **Berlin's Tempelhof Airport** now is handling about 30 scheduled and 20 freight charter flights daily. October traffic: 2,557 plane arrivals and departures; 56,639 passengers, plus 5,602 refugees; 4,000 tons of freight, and 240 tons of mail.

► **Central Airlines** has inaugurated service over 1,132 mi. of new routes in Arkansas, Oklahoma and Missouri, an increase of 70%. Central's fleet of DC-3s has been increased by a third to handle the new service.

► **Flying Tiger Line** has set up a 12-member employe executive committee to meet monthly with president Robert W. Prescott and discuss employe-management relations, improvement of operational efficiency and means of increasing business.

► **Resort Airlines** will add three flights to its regular two-a-week cruise schedule during the peak winter months of February and March. Additional flights will leave Miami Tuesday, Thursday and Saturday.

► **North Central Airlines** has initiated a travel credit plan calling for issuance of "on-line" credit cards for travel on North Central flights only.

► **Trans-Canada Air Lines** reports record traffic in 1954: 1,429,000 passengers carried represents an increase of 9% over 1953, and revenue passenger-miles, at 850,952,000, were up 12%. Last year, TCA took delivery of eight Super Constellations and the first of 22 Vickers Viscount transports on order.

► **Air France** is distributing a new travel kit to 2,000 agents in the United States to aid them in promoting sales for the French airline.

► **American Airlines** has scheduled a third daily airfreighter out of Los Angeles, bringing its total cargo lift capacity to nearly 62 tons daily from the West Coast city to eastern points. The new service is operated with DC-6As.

► **Pan American World Airways** reports it carried more trans-Atlantic passengers and mail than any other airline in 1954. Atlantic traffic last year totaled 150,014 passengers, 3.9 million lb. of mail and 4.6 million lb. of cargo.

► **Queen Charlotte Airlines, Ltd.** of Canada has installed new anti-collision lights on its DC-3s. They are tail-mounted amber flashing beacons.

AVIATION CALENDAR

Jan. 18—American Helicopter Society, Southeast Region dinner meeting, Washington Aviation Club, Washington, D. C.

Jan. 19-23—Miami International Aerorama, Miami (Fla.) International Airport.

Jan. 20-21—Institute of Radio Engineers and Radio-Electronics-Television Manufacturers Assn., Symposium on Printed Circuits, University of Pennsylvania, Philadelphia.

Jan. 20-22—Conference on High-Speed Aerodynamics, organized by the Department of Aeronautical Engineering of the Polytechnic Institute of Brooklyn, Engineering Societies Building, New York.

Jan. 24-27—American Meteorological Society, 135th national meeting, New York University College of Engineering, New York.

Jan. 24-27—Plant Maintenance & Engineering Show and three-day conference, International Amphitheatre, Chicago.

Jan. 24-28—Institute of the Aeronautical Sciences, 23rd annual meeting, Honors Night Dinner, Hotel Astor, New York.

Jan. 27-28—Southern California Meter Assn., fourth annual Instrument Short Course, Los Angeles Harbor Junior College, Wilmington, Calif.

Jan. 31-Feb. 3—Airlines Electronic Engineering Committee, winter meeting, Hotel Warwick, New York.

Jan. 31-Feb. 4—American Institute of Electrical Engineers, winter general meeting, Hotel Statler, New York.

Jan. 31-Feb. 4—American Society for Testing Materials, annual Committee Week, Netherland Plaza Hotel, Cincinnati.

Feb. 8-10—National Association of State Aviation Officials, winter meeting of board of directors, Lafayette Hotel, Washington, D. C.

Feb. 8-10—Society of the Plastics Industry, 10th Reinforced Plastics Division Conference, Hotel Statler, Los Angeles.

Feb. 10-11—Society of American Military Engineers, military-industrial conference on manpower, Conrad-Hilton, Chicago.

Feb. 11—Air Transport Command, 10th reunion dinner of World War II officers, Waldorf-Astoria Hotel, New York.

Feb. 20-22—Fourth annual Texas Agricultural Aviation Conference, A&M College of Texas, College Station, Tex.

Feb. 20-22—Institute of Surplus Dealers, trade show and convention, 212 AA Armory, New York.

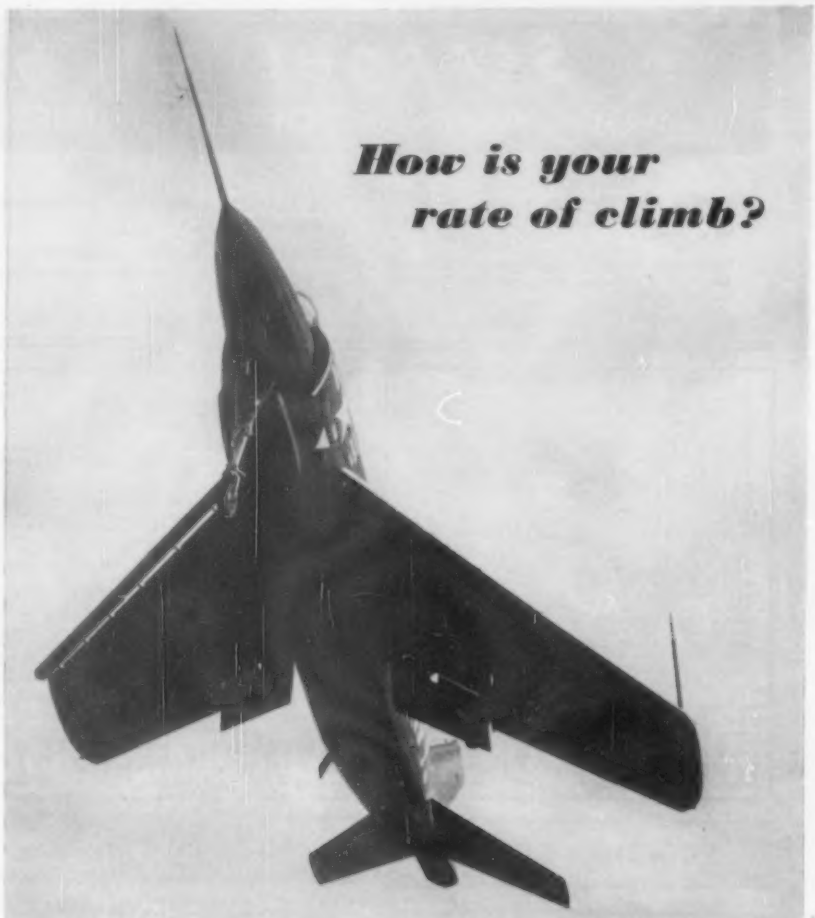
Feb. 21-22—National Model Plane Show, Higbee Co. auditorium, Cleveland.

Feb. 26-27—Associated Glider Clubs of Southern California, ninth annual Pacific Coast Mid-Winter Soaring Championships, Torrey Pines Glider Port, San Diego.

Mar. 11—Institute of the Aeronautical Sciences, National Flight Propulsion Meeting (attendance restricted), Hotel Carter, Cleveland.

Mar. 14-16—Society of Automotive Engineers, production meeting and forum, Netherland Plaza, Cincinnati.

Mar. 14-18—American Society of Tool Engineers, first Western Industrial Exposition, Shrine Auditorium and Convention Hall, Los Angeles.



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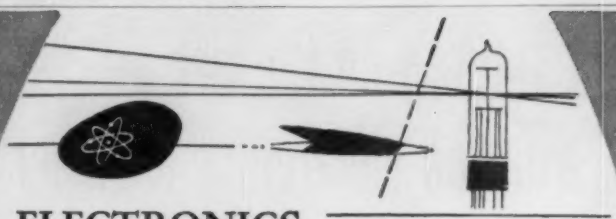

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SEARCHLIGHT SECTION OF AVIATION WEEK

Aging Is Airman's Greatest Foe

But aero-medical expert says chronological age is less important to pilots than functional capacity, efficiency.

By Dr. Ross A. McFarland

Aging has more significance for airmen than for most other occupational groups. Pilots are fully aware that changes in their flying abilities with increasing age may have far-reaching implications on their earning capacities. Management, too, has an interest in aging because of considerations of safety. Furthermore, the financial problem of depreciating high initial training costs over a shorter time must be considered if the strains imposed by modern flying require the retirement of pilots prematurely.

How old are pilots? Compared to the general population, pilots are a young group. Of employed males in the United States in 1950, 50% were over 40 years of age, while only 20.2% of airline pilots were this old; 28% of employed men, and 2.1% of pilots were 50 or over. Increasing numbers of older persons are now to be found among industrial personnel and the general public, and pilots also are beginning to show this trend. In 1946, 9.6% of airline pilots were over 40, 3.3% over 45, and only 1.4% older than 50. By 1950 these percentages had become, respectively, 20.2, 6.5, and 2.1.

At present some 350 airline pilots are in the 50-or-over age group, and about 40 active pilots are nearing the age of 60. An analysis made of pilots who were already 50 or more in 1949 shows that 71% still held Class I certificates in 1953, and more than half still were actively flying for airlines. The CAA expects that by 1957 there will be 847 Class I pilots in the 50-plus age group, and 1,640 by 1962. Among student and private pilots, approximately 2,000 now are 60 or more and hold medical certificates as fit to fly.

Functional age. Osler has said "a man is as old as his arteries." More broadly interpreted, a man's chronological age is less important than the degree of functional capacity and efficiency of his various body systems. The regulation of body temperature, the control of blood sugar, and of acid-base balance, are examples of the adaptive mechanisms by which a steady internal state is maintained. After about 40, the flexibility of such mechanisms may be reduced, and older persons have a narrower range of response in preserving this equilibrium under stressful situations. When stress is not present, older men in good health can adequately maintain this internal equilibrium. Regular exercise and high degree of physical fitness influence these adaptive mechanisms favorably.

Vision and age. All the senses are less efficient with advancing age. In aviation, special demands are placed on vision and hearing, and the significance of even small changes must be considered. The chief changes in vision are: decreasing ability to focus on near objects, decreasing visual acuity, and diminishing ability to see under low illumination. Glasses may correct the first two, but defects originally present may become accentuated with age, and adequate correction becomes impossible.

The decline in night vision may be the most important change. Seeing quickly and accurately, particularly during landings and take-offs is essential, and the pilot over fifty is likely to be handicapped in this respect. At times he may have to depend on the keener night vision of his younger co-pilot. When airports and runways are brightly lighted, however, the change in night vision is of no consequence.

Problems of hearing. In most people, some hearing loss has usually occurred by age 40. The loss is typically small, and chiefly confined to frequencies above 2,000 cps. What a pilot has to hear is in the range 500-3,000 cps., which covers the human voice and the chief auditory signals used. Signal amplification to offset hearing losses is not always feasible. For example, if the radio beam is given too much volume, the A and N signals cannot be differentiated, and accessory visual signals become imperative.

A maximum permissible hearing loss of 20 db. at 500, 1,000, and 2,000 cps., and of 25 db. at 3,000 cps. seems a reasonable standard for the initial selection of pilots. About 14% of the present pilot population would be grounded on this basis, however, and in all fairness, older pilots should be tested in the presence of cockpit noise. Noise interferes less with the hearing of the partially deaf person. If, in noise, hearing losses in pilots do not interfere with the intelligibility of conversation and signals, safety will not be compromised.

Age and skill. Reaction times tend to become longer as one grows older. Since most flight situations do not require instantaneous responses, however, slow reaction times may become critical only in landing, where a large number of acts are carried out in quick succession. Secondary factors of apprehension or fatigue are more apt to be the limiting influences. Research has shown that when older workers are not required to complete a series of rapid operations within narrow time limits, they perform as well or better than younger workers.

However, under time pressure, and especially when the situation involves new elements, older workers become prone to confusion and making errors. This has important implications when older pilots are transferred to newer, or more complex equipment, and special training may be required. Designing new equipment with this principle in mind would also serve to prolong the useful lives of airmen.

When should pilots retire? Changes which occur with age vary greatly from one person to another, but even minor changes in the physiological and psychological functions may interact to produce a significant loss in over-all efficiency. Until more experience is gained, however, an arbitrary retirement age for pilots seems inadvisable.

The training and experience older pilots have gained are valuable assets, and the emphasis should be on finding ways to preserve and prolong the active flying lives of pilots, and of utilizing their accumulated experience in other ways if prudence dictates an end to piloting. Each case should be considered individually, and on the basis of "functional age," rather than chronological age alone. A retirement program which considers not only the financial aspects but also the psychological aspects of reaching the climax of a career is important for the morale and efficiency of the flight group.

Most older pilots who have had difficulty in meeting the requirements have been over 50 years of age. The evaluation of "functional age" is thus most likely to be needed in the age range 50±5 years, when procedures can be instituted whereby the experience and capacities of an airman may be preserved, and the mutual interests of management and the airman most effectively served.

This is the third in a series of articles being written for Aviation Week by Dr. McFarland, associate professor of industrial hygiene at the School of Public Health, Harvard University, and author of the book, "Human Factors in Air Transportation—Occupational Health and Safety," published by McGraw-Hill, New York.

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LETTERS

VFR Traffic Law

I am unable to restrain my concern over a current problem, one which affects all of us. I'm speaking of the antiquated VFR traffic law and the manner in which it endangers all users of the federal airway system. It seems so inexcusably negligent for the CAA not to keep this regulation adjusted to the current traffic conditions. Likewise, it is a helpless feeling to envision a rash of unnecessary mid-air collisions simply because of this deficiency. Unless steps are taken to change the obsolete VFR law, and to crack down on unconscientious pilots who play it to the limit, then I feel a great injustice is being cast upon everyone concerned.

In its present status it is pitifully inadequate because of increased traffic, increased speed, *and no basic means of enforcement even if it were a good law.* There are no traffic cops in conjunction with this regulation and there must be! The VFR law is like an "open city" where anything can happen and usually does. This to me is an utter disregard by one man for another, and is potentially the most devastating avalanche of disrespect imaginable.

The law is weak. Therefore it encourages the acts of the weak. Consequently, the ignorant, the dishonest and unconscientious pilot is responsible for spreading this weakness. I'm referring more particularly to the VFR pilot who disregards its limitations. He's the fellow who talks up a great story on the ground, eloquently describing all his "ratings," but who actually hasn't got the ability nor the common decency to file an IFR plan and follow its specifications. He would rather hop the bushes or cheat by climbing up through without any plan. All of us who day by day hold fast to the creed of honesty and conscientiousness in flying know this to be true. Personally, I'm tired of this ruthless disregard for life and limb.

Now what is there that might be done about this situation? I believe the answers are many. Perhaps the items which I list below are too strong for some; nevertheless, they don't affect the pilot whose interest lies in safeguarding his passengers and himself.

1. Abolish the present VFR law entirely.
2. Increase VFR limitations to a ceiling of 1,500 feet and a visibility of five miles.
3. Abolish the so called controlled VFR approaches and departures from airport areas. This has never been anything but a means to cheat legally, and it endangers existing instrument traffic.
4. Deputize all control tower operators, CAA agents and airport managers so that they can say yes or no to anyone who wants to operate in conditions less than those mentioned in item No. 2. The regulations must be brought home to these violators by means of heavy fines and license revocations. This type of "big stick" enforcement is necessary. Nothing can be done at present because *no one has the power nor the authority.*
5. Abolish the 700-foot airway boundary. When the weather is less than 1,500 and five, no VFR traffic should be operating. Have you ever broken contact during an instrument approach just in time to narrowly miss a collision with some VFR "Dilbert" cruising along right in the middle of the localizer? I have. This is not comical to me. I don't care to die yet, but I stand a damn good chance unless the CAA rectifies this condition. The way the law is written now, this VFR gent in the middle of the approach corridor is legal!
6. Instigate a widespread campaign to put some down to earth understanding in the minds of these violators. Encourage them to think instead of having their heads "up and locked" all the time.

Please note that I make no reference nor am I talking about instrument traffic regulations. My hat is off to the many airway traffic control centers throughout the country who are doing a magnificent job with the available facilities and manpower. They could use more equipment, more personnel, and more appreciation from the many "prima donnas" who grace our airways today. Their responsibility of coordinating all instrument traffic is contributing vastly to the ultimate safety of thousands of pilots and millions of passengers.

A. G. W.
Executive Pilot

Nonsked Air Exchange

The headline over your December 6th story on the air exchange case, now in CAB hearing stage, makes it appear that there is a "clash" between ACTA and IMATA, the two associations seeking clearance of an exchange plan.

Actually, as I stated on the witness stand, ACTA has no objection to IMATA operating an air exchange similar to the one we propose, either separately or jointly with us. The two groups had a joint control board from which IMATA withdrew a year ago. Though we have continued to gain traffic singly, we have always been willing to get together again and to consider full merger.

In the air exchange proposals, there is no big difference except that IMATA asks only for plane-load charters. ACTA thinks multiple charters, within reasonable limits, are essential to develop traffic—more than one group of passengers on a plane, or cargo from more than one shipper. We think it would be good for the IMATA members as well as ours if the broader plan is approved.

As to IMATA having thought of the exchange before ACTA, our records show detailed discussions in ACTA meetings months before the present IMATA management took office though we chose to keep quiet at the time. But the British have been doing this sort of thing on the sea for 200 years. They began to talk about extending it to air in 1938 and did so in 1948, before either ACTA or IMATA was formed. So U. S. priority means little and is not a factor in the pending case.

H. B. Johnston
President
Aircoach Transport Association, Inc.
Suite 211, Wyatt Building
777 14th Street, N.W.
Washington 5, D.C.

TAC Mobile Force

The lead-off article in your November 22nd issue, "TAC Shapes Mobile Atomic Strike Force," attracted considerable and favorable attention here. May we have your permission to reproduce this article for use in our employe organ, as well as for local and area use through a public information release?

We will be careful, of course, to give full credit to Aviation Week as the source.

Best regards.

Chess Abernathy, Jr.
Public Information Department
Lockheed Aircraft Corp.
Georgia Division
Marietta, Ga.

Two Firms Omitted

It was generous of you to give the Flight Safety Foundation such recognition in your editorial of Jan. 3, 1955. We especially appreciate the fact that the interest of you and your staff in aviation safety is so deep that you not only devoted a full editorial page to it but continually emphasize safety in your other editorials and articles. We believe that your interest coincides with the interest of the aviation industry on this vital subject.

There are two omissions in the list of organizations that attended the Seminar: Walter Kidde Company which has long supported the activities of the Flight Safety Foundation both morally and with funds, and also the Cornell Aeronautical Laboratory.

Jerome Lederer
Office of The Managing Director
Flight Safety Foundation, Inc.
47 Park Avenue
New York 22, N. Y.

Folding Tails, Wings

A recent feature on the Douglas A3D-1, written by my old friend Dave Anderton, contained a statement to the effect that this is the first Navy airplane to be equipped with a folding vertical tail and wings. The statement is not quite true.

In the interest of accuracy, it might be well to correct the information. The North American AJ-1 Savage has been in active squadron service since 1950, and has this same feature. The AJ-2 and AJ-2P also are equipped in a like manner. But that is not the end. Our own XA2J-1 was also equipped with a folding vertical tail and folding wings, and this design was also flown prior to the first flight of the XA3D-1.

I am an active aviation enthusiast from way back, and I must say that your magazine is the only American journal on the subject that is worth reading. The reading is neither too "light" or too "heavy" for industry readers.

Warren M. Bodie
Service Engineer, F-86H Project
North American Aviation, Inc.
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Los Angeles 45, Calif.

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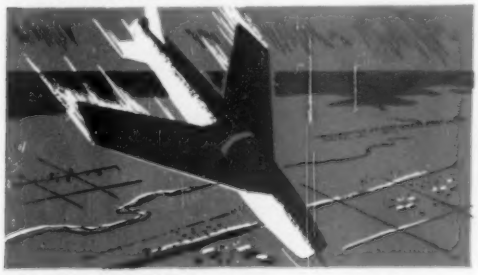

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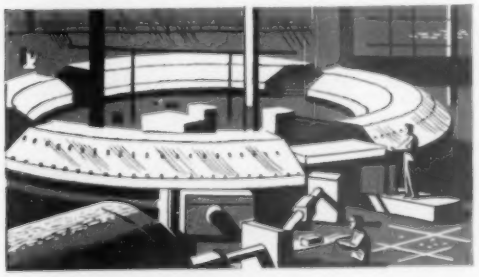

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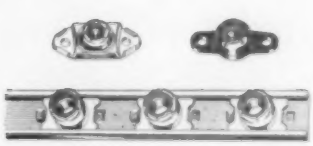
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